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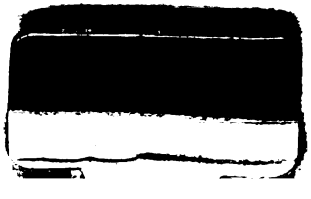

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59TH CONGRESS, 1st Session. } HOUSE OF REPRESENTATIVES. { DOCUMENT No. 2.

ANNUAL REPORTS

OF THE

WAR DEPARTMENT

FOR THE

FISCAL YEAR ENDED JUNE 30, 1905.

2

VOLUME VI.

REPORT OF THE CHIEF OF ENGINEERS.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1905.

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ARRANGEMENT OF THE ANNUAL REPORTS OF THE WAR DEPARTMENT FOR THE YEAR ENDED JUNE 30, 1905.

Volume I.....Secretary of War:
Chief of Staff.
The Military Secretary.
Inspector-General.
Judge-Advocate-General.

Volume II.....**Armament, Transportation and Supply:**
Quartermaster-General.
Commissary-General.
Surgeon-General.
Paymaster-General.
Chief of Engineers, Military Affairs.[a]
Chief of Ordnance.[b]
Chief Signal Officer.
Chief of Artillery.
Board of Ordnance and Fortification.

Volume III.....**Division and Department Commanders:**
Atlantic Division—
1. Department of the East.
2. Department of the Gulf.

Northern Division—
1. Department of the Lakes.
2. Department of the Missouri.
3. Department of Dakota.

Southwestern Division—
1. Department of Texas.
2. Department of the Colorado.

Pacific Division—
1. Department of California.
2. Department of the Columbia.

Philippines Division—
1. Department of Luzon.
2. Department of the Visayas.
3. Department of Mindanao.

Volume IV.....**Militia Affairs, Military Schools and Colleges, Military Parks, and Soldiers' Homes.**
The Military Secretary, Militia Affairs.
Military Academy—
1. Board of Visitors.
2. Superintendent.

Infantry and Cavalry School and Staff College.
School of Application for Cavalry and Field Artillery.
Artillery School.
Engineer School.
School of Submarine Defense.
Army Medical School.
Commissioners of National Military Parks—
1. Chickamauga and Chattanooga.
2. Gettysburg.
3. Shiloh.
4. Vicksburg.

Soldiers' Home, District of Columbia—
1. Board of Commissioners.
2. Inspection of.

Inspection of National Home for Disabled Volunteer Soldiers.

Volumes V–VIII....Chief of Engineers.

Volume IX.....Chief of Ordnance.

Volumes X–XIV....The Chief of the Bureau of Insular Affairs, the Philippine Commission, and Acts of the Philippine Commission.

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[a] Printed in Report of Chief of Engineers, Vol. V.
[b] Printed in Report of Chief of Ordnance, Vol. IX.

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APPENDIX N.

IMPROVEMENT OF WACCAMAW RIVER, NORTH CAROLINA AND SOUTH CAROLINA, AND OF CERTAIN RIVERS AND HARBORS IN SOUTH CAROLINA.

REPORT OF CAPT. G. P. HOWELL, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1905, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Waccamaw River, North Carolina and South Carolina, and Little Pedee River, South Carolina.
2. Great Pedee River, South Carolina.
3. Winyah Bay, South Carolina.
4. Santee, Wateree, and Congaree rivers, and Estherville and Minim Creek Canal, South Carolina.
5. Congaree River, South Carolina, from Gervais Street Bridge, Columbia, to Granby.
6. Inland waterways between Charleston Harbor, South Carolina, and opposite McClellanville.
7. Harbor at Charleston, South Carolina.
8. Wappoo cut, South Carolina.
9. Inland waterway between Charleston and Beaufort, South Carolina.
10. Beaufort River, South Carolina.
11. Removing sunken vessels or craft obstructing or endangering navigation.

UNITED STATES ENGINEER OFFICE,
Charleston, S. C., July 20, 1905.

GENERAL: I have the honor to transmit herewith my annual reports for the fiscal year ending June 30, 1905, for the works of improvement of rivers and harbors in this district.

Very respectfully,

G. P. HOWELL,
Captain, Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

N 1.

IMPROVEMENT OF WACCAMAW RIVER, NORTH CAROLINA AND SOUTH CAROLINA, AND LITTLE PEDEE RIVER, SOUTH CAROLINA.

(A) WACCAMAW RIVER.

Snagging was done by the snag boat *Little Pedee* in October and November, 1904, and in April and May, 1905. Most of the work was

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done above Conway. The expenditure was $1,182.08. There were 851 obstructions removed, at a cost of $1.38 per unit.

About 79 per cent of the approved project had been completed to June 30, 1905.

It is proposed to apply the available balance and additional appropriations recommended in deepening and straightening the channel below Conway, forming a good 6-foot channel. Afterwards the dredging will be extended above Conway. The cleared channel above Conway will be maintained.

Money statement.

July 1, 1904, balance unexpended		$624.35
Amount appropriated by river and harbor act approved March 3, 1905		13,800.00
		14,424.35
June 30, 1905, amount expended during fiscal year, for maintenance of improvement		1,182.08
July 1, 1905, balance unexpended		13,242.27
July 1, 1905, outstanding liabilities		439.27
July 1, 1905, balance available		12,803.00
Amount (estimated) required for completion of existing project		46,800.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$12,000.00	
For maintenance of improvement	3,000.00	
		15,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

APPROPRIATIONS.

June 14, 1880	$15,000	August 18, 1894	$6,000
March 3, 1881	10,000	June 3, 1896	6,000
August 2, 1882	4,400	March 3, 1899	3,000
July 5, 1884	6,000	June 13, 1902	9,000
August 5, 1886	15,000	March 3, 1905	13,800
August 11, 1888	15,000		
September 19, 1890	12,500	Total	125,700
July 13, 1892	10,000		

Total expenditures, including June 30, 1905, $112,457.73.

COMMERCIAL STATISTICS, 1904.

Articles.	Quantity.	Value.
Outward freights:	*Tons.*	
Naval stores	7,500	$200,000
Cotton	1,500	275,000
Timber, lumber, etc	160,000	625,000
Fish, game, and vegetables	700	75,000
Rice and rice flour	1,235	44,040
Miscellaneous	1,500	150,000
Total	172,435	1,369,040
Inward freights: Miscellaneous merchandise and fertilizers	18,000	750,000
Grand total	190,435	2,119,040

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List of vessels plying Waccamaw River, South Carolina, during calendar year 1904.

Name.	Character.	Length.	Breadth.	Depth.	Gross tonnage.
		Feet.	*Feet.*	*Feet.*	
Gov. Safford	Side-wheel steamer	129.6	26.0	7.5	307
Merchant	do	147.7	29.6	5.4	405
Ruth	do	81.0	26.0	4.0	89
F. G. Burroughs	do	125.0	23.0	6.0	283
Eutaw	do	156.0	29.8	7.8	547
Wm. P. Congdon	Screw steamer	75.2	18.0	7.8	68
E. T. Williams	do	81.0	21.0	9.0	97
Henry Lloyd	do	40.5	12.2	4.8	13
Fearless	do	58.0	11.0	4.0	18
Emma A. Twiggs	do	53.0	13.2	4.5	16
Pender	do	52.7	14.9	3.4	28
Bertie	do	49.5	9.8	3.5	16
Robert E. Lee	do	67.0	17.0	4.5	56
Frank Sessions	Stern-wheel steamer	86.6	22.8	8.6	79
Myra W. Spear	Schooner	99.2	27.6	7.5	156
E. A. Danenhauer	do	116.6	30.2	7.4	228
Robt. McClintock	do	96.0	26.7	7.4	154
Bayard Hopkins	do	118.0	30.0	9.0	269
Wm. Linthicum	do	112.0	27.6	8.0	156
Venus	do	108.0	29.4	9.1	204
John Russell	do	66.2	23.2	4.7	36
Crescent	do	150.8	24.8	12.4	463
Edward L. Martin	do	87.2	23.6	6.8	84
Edgar C. Ross	do	144.2	34.3	10.0	399
Ruby & Bessie	do	105.8	28.9	8.7	138
Willie	Yacht	40.0	9.0	4.0	a 6
Madge	do	35.0	7.0	2.0	a 3
Sprite	Yacht, naphtha	37.0	8.0	3.0	a 5
Leilah	do	40.0	8.0	3.0	5
Pelican	do	30.0	7.0	2.5	3
Richard Linthicum	Schooner	121.5	24.8	9.0	191

a Approximate.

(B) LITTLE PEDEE RIVER.

A hand force with deck lighter began working in April, 1905, and removed from the channel 1,180 obstructions, and from the banks 336 trees and 59½ cords of brush, at a unit cost of 42 cents. The work was done between the mouth and Gallivants Ferry.

About 50 per cent of the approved project had been completed to June 30, 1905.

It is proposed to expend the available balance and additional appropriations recommended in snagging the stream and in making a survey to determine the cost of forming a channel 5 feet deep.

Money statement.

July 1, 1904, balance unexpended	$180.23
Amount appropriated by river and harbor act approved March 3, 1905	1,200.00
	1,380.23
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	272.93
July 1, 1905, balance unexpended	1,107.30
July 1, 1905, outstanding liabilities	292.92
July 1, 1905, balance available	814.38
Amount (estimated) required for completion of existing project	29,300.00

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Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:

For works of improvement	$6,000.00	
For maintenance of improvement	2,500.00	
		$8,500.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

APPROPRIATIONS.

August 11, 1888	$5,000	June 13, 1902	$1,500
September 19, 1890	5,000	March 3, 1905	1,200
July 13, 1892	5,000		
August 18, 1894	4,000	Total	24,700
June 3, 1896	3,000		

Total expenditures, including June 30, 1905, $23,592.70.

COMMERCIAL STATISTICS, 1904.

Articles.	Quantity.	Value.
Outward freights:	*Tons.*	
Naval stores	300	$10,000
Cotton	400	100,000
Lumber, timber, and cordwood	80,000	475,000
Total	80,700	585,000
Inward freights:		
Miscellaneous	400	20,000
Fertilizers	2,000	40,000
Grand total	83,100	645,000

List of vessels plying Little Pedee River, South Carolina, during calendar year 1904.

Name.	Character.	Length.	Breadth.	Depth.	Gross tonnage.
		Feet.	*Feet.*	*Feet.*	
Ruth	Side-wheel steamer	81	26.0	4.0	89
Almont	Yacht	40	8.0	5.0	4
Loretta	do	40	9.0	3.0	7
Willie	do	40	9.0	4.0	6
Pelican	do	30	7.0	2.5	3
Armstrong	Stern-wheel steamer	60	12.5	2.5	22

N 2.

IMPROVEMENT OF GREAT PEDEE RIVER, SOUTH CAROLINA.

Snagging operations were carried on during the year by the self-propelling snag boats *Great Pedee* and *Little Pedee* between the mouth and Cheraw, 172 miles above, and 2,307 obstructions were removed at an approximate cost of $1.53 per unit.

The *Great Pedee* was provided with a grapple bucket and was equipped as a dredge. With the aid of the steamer *Waccamaw* and two side-dump lighters 965 cubic yards of material were removed in June.

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The hull of the combination dredge and snag boat *Reid Whitford*, which was built by contract at Wilmington, Del., for $18,000, was delivered at Georgetown, S. C., in April and the installation of the machinery and the construction of the housing was begun. The hull is of steel. It is expected that the boat will begin work in September.

About 80 per cent of the old project had been completed to June 30, 1905. Beyond a little snagging and the construction of the new combination dredge and snag boat, no work has been done on the new project.

It is proposed to expend the available balance and additional appropriation recommended in maintaining the general improvement and in obtaining a channel in the upper river.

Money statement.

July 1, 1904, balance unexpended		$61,777.38
Amount appropriated by sundry civil act approved March 3, 1905		15,000.00
Amount appropriated by river and harbor act approved March 3, 1905		5,000.00
		81,777.38
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$34,526.61	
For maintenance of improvement	711.55	
		35,238.16
July 1, 1905, balance unexpended		46,539.22
July 1, 1905, outstanding liabilities		4,737.39
July 1, 1905, balance available		41,801.83
July 1, 1905, amount covered by uncompleted contracts		3,513.30
Amount (estimated) required for completion of existing project		41,300.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$20,000.00	
For maintenance of improvement	5,000.00	
		25,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

APPROPRIATIONS.

June 14, 1880	$7,000	June 3, 1896	$12,000
March 3, 1881	6,000	March 3, 1899	4,000
August 2, 1882	6,000	June 13, 1902	22,500
July 5, 1884	8,000	March 3, 1903	40,000
August 5, 1886	20,000	April 28, 1904	10,000
August 11, 1888	20,000	March 3, 1905	15,000
September 19, 1890	12,500	March 3, 1905	5,000
July 13, 1892	10,000		
August 18, 1894	6,000	Total appropriations	204,000

Total expenditures, including June 30, 1905, $157,460.78.

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CONTRACTS IN FORCE.

Name of contractor.	Contract for—	Price.	Date of—		
			Contract.	Beginning.	Expiration.
Schoellhorn-Albrecht Machine Co.	Two marine engines.	$2,150	June 1, 1904	June 11, 1904	Aug. 10, 1904
The Harlan & Hollingsworth Company.	Steel hull	18,000	July 18, 1904	Oct. 16, 1904	Apr. 4, 1905
Do	Machinery, etc., for new hull.	10,315	Sept. 17, 1904	Sept. 27, 1904	Feb. 1, 1905

COMMERCIAL STATISTICS, 1904.

Articles.	Quantity.	Value.
Outward freights:	*Tons.*	
Naval stores	714	$25,996
Cotton	1,440	288,050
Lumber, timber, and cross-ties	142,416	562,000
Rice	1,437	40,962
Miscellaneous	694	27,673
Total	146,701	904,681
Inward freights: Miscellaneous merchandise and fertilizers	15,865	602,500
Grand total	162,566	1,507,181

List of vessels plying Great Pedee River, South Carolina, during calendar year 1904.

Name.	Character.	Length.	Breadth.	Depth.	Gross tonnage.
		Feet.	*Feet.*	*Feet.*	
Merchant	Side-wheel steamer	147.7	29.6	4.5	405
Frank Seesoms	Stern-wheel steamer	86.6	22.8	3.6	79
Wm. P. Congdon	Screw steamer	75.2	18.0	7.8	68
Henry Lloyd	do	40.5	12.2	4.8	18
Fearless	do	58.0	11.0	4.0	18
Emma A. Twiggs	do	53.0	13.2	4.5	16
Pender	do	52.7	14.9	3.4	28
Bertie	do	49.5	9.8	3.5	16
Robert E. Lee	do	67.0	17.0	4.5	56
Myra W. Spear	Schooner	99.2	27.6	7.5	156
E. A. Danenhauer	do	166.6	30.2	8.7	228
Robt. McClintock	do	96.0	26.7	7.4	154
Bayard Hopkins	do	118.0	30.0	9.0	269
Wm. Linthicum	do	112.0	27.6	8.0	156
Venus	do	108.0	29.4	9.1	204
John Russell	do	66.2	22.2	4.7	36
Crescent	do	150.8	34.8	12.4	463
Helen L. Martin	do	87.2	23.6	8.6	84
Edgar C. Ross	do	144.2	34.3	10.0	399
Ruby & Bessie	do	105.8	28.9	8.7	138
Pelican	Steam yacht	30.0	7.0	2.5	3
Willie	do	40.0	9.0	4.0	6
Madge	do	35.0	7.0	2.0	3
Sprite	do	37.0	8.0	3.0	5
Leilah	do	40.0	8.0	3.0	5
Loretta	do	40.0	9.0	3.0	7
Maria C	do	35.0	10.0	4.5	8
Richard Linthicum	Schooner	121.5	24.8	9.0	191
Armstrong	Stern-wheel steamer	60.0	12.5	2.5	22

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N 3.

IMPROVEMENT OF WINYAH BAY, SOUTH CAROLINA.

At the beginning of the year the seagoing suction dredge *Winyah Bay* was away undergoing annual repairs. Upon their completion the boat was ordered to Pensacola, Fla., where it remained at work till March 1, 1905. During March and part of April it was under repair at Jacksonville, Fla., after which it towed the hull of a dredge built by contract from Wilmington, Del., to Georgetown, S. C. Work was resumed in Winyah Bay April 14, 1905, and was in progress at the close of the fiscal year. From the eastern channel in upper Winyah Bay 98,303 cubic yards were removed. The dredge worked sixty-one days, was absent for repairs and cleaning boilers five days, and lost twelve days on account of Sundays and holidays. It consumed 333 tons of coal.

As the dredge worked such a short time at Winyah Bay, the cost of general repairs, care of plant, superintendence, and office expenses has not been included in the cost of dredging. The actual cost per cubic yard, considering simply the crew of the boat, was 5 cents. The expenditures were as follows:

Labor	$2,505.01
Subsistence	603.89
Fuel	1,051.94
Lighting supplies and lubricants	194.20
Repairs	530.06
Permanent outfit	26.88
Total	4,911.98

The dredge *Charleston* was sent in the latter part of May to work in the jetty channel. On the first day it broke its tail shaft and had to be towed back to Charleston for repairs, where it was at the close of the fiscal year.

Dredge *No. 3* removed from the Sampit River shoal, opposite Georgetown, 27,593 cubic yards of material, at a cost of 37 cents per cubic yard. The high cost is due to the fact that the dredge had just been constructed and required numerous alterations.

The south jetty was extended about 2,600 feet from the termination of the stonework to the mud dike connecting the high land on South Island and the high land near the Santee River. The structure was a double row of sheet piling completely covered with marsh mud. The work was done by contract, at a total cost, including superintendence, of $35,052.73.

The extension of the mud dike to its terminus on Pine Ridge was completed, with the exception of a section 150 feet long that had settled. Work was done by hand force at a cost of 58 cents per cubic yard and by clam-shell dredge *No. 2* at a cost of 29 cents per cubic yard. Sodding was placed on portions of the old dike and also on the new extension, at a cost of 14 cents per square yard.

For the construction of the combination dredge and snag boat *Reid Whitford*, to be used mainly on the Great Pedee River and Winyah bay, $10,315 was spent.

It is proposed to expend the available balance in dredging in the entrance channel and at the shoal places between the entrance and

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the city of Georgetown, in repairs to the jetties, and in repairs to the mud dike.

Money statement.

July 1, 1904, balance unexpended		$247,178.35
Amount appropriated by sundry civil act approved March 3, 1905		75,000.00
Amount appropriated by river and harbor act approved March 3, 1905		10,000.00
Received for rent of dredge		5,670.00
		337,848.35
June 30, 1905, amount expended during fiscal year:		
Treasury settlement	$10.15	
For works of improvement	107,365.91	
For maintenance of improvement	3,240.20	
		110,616.26
July 1, 1905, balance unexpended		227,232.09
July 1, 1905, outstanding liabilities		9,006.79
July 1, 1905, balance available		218,225.30
July 1, 1905, amount covered by uncompleted contracts		3,513.30
Amount (estimated) required for completion of existing project		72,750.00

APPROPRIATIONS.

August 5, 1886	$18,750.00	April 28, 1904	$70,000.00
August 11, 1888	100,000.00	March 3, 1905	75,000.00
September 19, 1890	100,000.00	March 3, 1905	10,000.00
July 13, 1892	100,000.00		
August 18, 1894	110,000.00	Total appropriations	2,382,250.00
June 3, 1896	20,000.00		
June 4, 1897	350,000.00	Received account of Treasury settlement and auction sales	58.76
July 1, 1898	450,000.00		
March 3, 1899	58,500.00	For rent of dredge	5,670.00
June 6, 1900	285,000.00		
March 3, 1901	500,000.00	Total receipts	2,387,978.76
June 28, 1902	35,000.00		
March 3, 1903	100,000.00		

Total expenditures, including June 30, 1905, $2,160,746.67.

CONTRACTS IN FORCE.

Name of contractor: Simons-Mayrant Company.
Constructing cofferdam dike (material in place).
Price per unit in place: 285,000 feet B. M. lumber, at $25; 680 guide piles, at $7; 22,500 cubic yards mud filling, at 55 cents; 300 cords brush, at $2.
Date of approval: June 24, 1904.
Date of beginning: June 28, 1904.
Date of expiration: April 28, 1905.

EMERGENCY CONTRACT.

Name of contractor: C. B. Colbert.
Contract for installing machinery in new dredge.
Price: $3,513.30.
Date of contract: November 15, 1904.
Date of beginning: April 15, 1905.
Date of expiration: August 15, 1905.

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COMMERCIAL STATISTICS, 1904.

Articles.	Quantity.	Value.
Outward freights:	*Tons.*	
Naval stores	12,924	$407,548
Cotton and cotton seed	4,225	597,560
Rice	3,509	140,000
Lumber, timber, shingles, and cross-ties	304,980	2,620,473
Fish, game, and vegetables	1,887	181,262
Miscellaneous	1,239	1,660,000
Total	328,774	5,546,843
Inward freights: Miscellaneous	41,000	4,000,000
Grand total	369,774	9,546,843

List of vessels plying Winyah Bay and entering port of Georgetown, S. C., during calendar year 1904.

Name.	Character.	Length.	Breadth.	Depth.	Gross tonnage.
		Feet.	*Feet.*	*Feet.*	
Navahoe	Screw steamship	282.9	34.3	21.8	1,879
Katahdin	do	230.1	38.0	14.0	1,390
Richmond	do	206.0	33.0	21.6	1,437
Aragon	do	247.7	42.6	14.8	1,450
Wm. P. Congdon	Screw steamer	72.2	18.2	7.8	68
Henry Lloyd	do	40.5	12.2	4.8	13
Fearless	do	58.0	11.0	4.0	18
Emma A. Twiggs	do	53.0	13.2	4.5	16
Pender	do	52.7	14.9	3.4	28
Bertie	do	49.5	9.8	3.5	16
E. T. Williams	do	81.0	21.0	9.0	97
Robert E. Lee	do	67.0	17.0	4.5	56
Mabel S	do	65.3	17.7	6.0	48
Frank Sessoms	Stern-wheel steamer	86.6	22.8	3.6	79
Merchant	Side-wheel steamer	147.7	29.6	5.4	405
Gov. Safford	do	129.6	26.0	7.5	307
Ruth	do	81.0	26.0	4.0	89
F. G. Burroughs	do	125.0	22.0	6.0	283
Wm. Elliott	do	101.0	31.0	6.0	171
Eutaw	do	156.0	29.8	7.8	547
Planter	do	155.0	32.8	9.1	499
Winyah	Schooner	43.2	16.4	6.1	18
We Go	do	44.0	13.7	4.8	18
Hugh	do	47.6	14.2	3.4	14
Bayard Hopkins	do	118.0	30.0	9.0	269
Wm. Linthicum	do	112.0	27.6	8.0	156
Robt. McClintock	do	96.0	26.7	7.4	154
E. A. Danenhaner	do	116.6	30.2	8.7	228
Warren B. Potter	do	130.0	32.4	12.0	368
Chas. H. Sprague	do	122.0	30.7	9.5	318
Myra W. Spear	do	99.2	27.6	7.5	156
Helen L. Martin	do	87.2	23.6	6.8	84
Rebecca R. Douglas	do	138.8	33.9	9.5	475
Nellie Floyd	do	136.0	33.0	15.4	457
Golden Ball	do	124.2	30.3	10.5	286
Venus	do	108.0	29.4	9.1	204
Sarah D. J. Dawson	do	140.5	34.8	11.1	337
John T. Russell	do	66.2	22.2	4.7	86
William Churchill	do	143.6	34.7	11.0	432
Nathan Lawrence	do	168.4	35.2	15.1	770
Ruby & Bessie	do	105.0	28.9	8.7	138
Jessie Barlow	do	120.6	30.4	11.1	262
William H. Davison	do	33.2	12.0	5.0	10
F. W. McCullough	do	99.4	28.0	8.0	165
William H. Skinner	do	129.2	30.2	9.0	262
J. W. Hutt	Schooner, English	(a)	(a)	(a)	380
City of Georgetown	Schooner	168.7	36.4	12.6	599
S. E. Hall	do	147.8	35.0	11.0	384
Crescent	do	105.8	34.8	12.4	468
F. C. Pendleton	do	145.7	33.2	12.3	408
Lottie R. Russell	do	122.8	32.6	9.9	304
John A. Curtis	do	111.2	23.6	8.5	155
Wm. P. Hood	do	158.4	36.4	16.9	665
Grace Seymour	do	166.0	34.2	16.0	633
Etta	Sloop	47.0	11.6	3.3	8

(a) Unknown.

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List of vessels plying Winyah Bay and entering port of Georgetown, S. C., during calendar year 1904—Continued.

Name.	Character.	Length.	Breadth.	Depth.	Gross tonnage.
		Feet.	*Feet.*	*Feet.*	
Clipper	Sloop	31.0	11.0	2.9	10
Leila	do	31.0	10.0	2.5	8
Liza Jane	do	40.8	12.5	4.9	17
Willie	Yacht	40.0	9.0	4.0	a6
Madge	do	35.0	7.0	2.0	a3
Sprite	Yacht, naphtha	37.0	8.0	3.0	a5
Leilah	Yacht	40.0	8.0	3.0	a5
Wave	Yacht, naphtha	a35.0	a7.0	a3.0	a4
Wee-Nee	do	a30.0	a6.0	a3.0	a4
Pilot	Launch, naphtha	a25.0	a6.0	a2.0	a3
Advance	Yacht	25.0	5.5	1.5	a2
Loretta	do	40.0	9.0	3.0	a7
Syra	do	36.0	7.0	3.0	a3
Thistle	do	43.6	11.5	3.9	a13
Almont	do	40.0	8.0	5.0	a4
Pelican	do	30.0	7.0	2.5	a3
Maria C	do	35.0	10.0	4.5	a8
Petrel	do	40.0	10.0	3.5	a9
Saxon	Barge	(b)	(b)	(b)	(b)
Thos. W. Moore	Schooner	59.2	20.5	5.5	32
John Paul	do	137.4	32.7	12.3	410
Charles Noble Simmons	do	168.0	35.5	15.7	753
Louis Bossert	do	169.6	36.2	12.8	605
Carrie A. Norton	do	158.9	33.3	12.0	559
Thomas G. Smith	do	143.2	34.5	14.9	513
Everet Webster	do	140.6	35.0	11.1	476
Maude H. Dudley	do	139.3	33.2	10.7	392
Massachusetts	do	165.3	36.3	11.0	501
Laconic	do	56.6	14.1	4.4	19
Edgar C. Ross	do	144.2	34.3	10.2	399
John G. Schmidt	do	133.6	35.0	9.8	425
Chas. G. Endicott	do	171.6	38.0	18.7	856
Richard Linthicum	do	121.5	24.8	9.0	191
Tyre	do	47.4	12.4	3.2	12
Thos. A. Goddard	Bark	154.0	34.0	18.0	715
Big Four	Screw tug	59.0	14.0	8.0	26
D. D. Haskell	Schooner	131.2	31.1	11.0	317
W. H. Brown	do	57.5	26.2	7.0	62
John R. Bergen	do	152.0	35.0	17.0	647
Charlotte T. Sibley	do	140.2	32.4	10.8	376
Saint Olof	do	60.2	16.6	6.0	34
H. C. Kulick	do	34.8	11.3	3.2	7
Admiral	do	60.8	20.6	6.6	41
Celia E	do	145.7	34.4	12.0	412
Benjamin Russell	do	100.9	28.0	7.1	154
Patriot	do	85.6	22.4	8.8	81
Gen. Adelbert Ames	do	144.5	33.0	12.0	476
Harold J. McCarty	do	133.1	31.8	9.1	312
Adelia D. Carleton	do	111.6	28.4	11.6	247
Carib	Screw steamship	275.6	35.2	14.3	2,087
Sarah D. Fell	Schooner	145.4	35.3	14.9	578
James B. Jordan	do	162.7	35.5	17.7	722
Sam'l T. Beachum	do	121.0	23.7	8.2	185
Emily F. Northam	do	131.2	33.0	10.6	332
Husted	Yacht	a41.0	a9.0	a4.5	a11
Coral Reef (British)	do	(b)	(b)	(b)	(b)
John S. Beachum	Schooner	107.4	28.6	8.4	284
Eliza J. Pendleton	do	180.1	35.9	17.9	751
Chas. A. Whitler	do	(b)	(b)	(b)	(b)
J. W. Star	do	(b)	(b)	(b)	(b)
Emanuel (Sweden)	Screw steamer	(b)	(b)	(b)	(b)
Chas. J. Dundas	Schooner	(b)	(b)	(b)	(b)
Hibernia (British)	do	(b)	(b)	(b)	(b)
Samuel Davidson	do	(b)	(b)	(b)	(b)
Addie	Yacht, naphtha	a35.0	a7.0	a3.0	a4
Lottie C	do	a30.0	a6.0	a2.0	a3
Spray	do	a35.0	a8.0	a4.0	a5

a Approximate. b Unknown.

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N 4.

IMPROVEMENT OF SANTEE, WATEREE, AND CONGAREE RIVERS, SOUTH CAROLINA.

(A) SANTEE RIVER.

Dredge *No. 3* removed at shoal places in the Estherville-Minim Creek canal 10,978 cubic yards of material, at a cost of 18 cents per cubic yard. The expenditure was $2,003.06. Some snagging was done in the canal; there were 68 obstructions removed, at a cost of $2.93 per unit. The expenditure was $199.67.

In the Santee River the self-propelling snag boat *Great Pedee* removed 213 obstructions, at a cost of $3.94 per unit. The expenditure was $840.03.

In addition, $1,833.33 was spent for office expenses and for caring for the property at Smithville and maintaining the canal banks.

About 83 per cent of the approved project had been completed to June 30, 1905.

It is proposed to apply the available balance and additional appropriations recommended in widening and deepening the Estherville-Minim Creek canal in accordance with the project, in snagging the Santee River, and in dredging and removing obstructions from the lakes or arms of the river to provide landings.

Money statement.

July 1, 1904, balance unexpended	$8,449.14
Amount appropriated by river and harbor act approved March 3, 1905	25,000.00
	33,449.14
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	4,876.09
July 1, 1905, balance unexpended	28,573.05
July 1, 1905, outstanding liabilities	8.96
July 1, 1905, balance available	28,564.09
Amount (estimated) required for completion of existing project	142,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:	
For works of improvement	$25,000.00
For maintenance of improvement	5,000.00
	30,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

March 3, 1881	$22,000	March 3, 1899	$20,000
August 3, 1882	20,000	June 13, 1902	15,000
July 15, 1884	15,000	June 13, 1902	7,000
August 5, 1886	18,750	March 3, 1905	25,000
August 11, 1888	24,000		
September 19, 1890	30,000	Total appropriations	314,750
July 13, 1892	30,000	Account of sales at auction	13
August 18, 1894	40,000		
June 3, 1896	48,000	Total receipts	314,763

Total expenditures, including June 30, 1905, $286,189.95.

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COMMERCIAL STATISTICS, 1904.

Articles.	Quantity.	Value.
Outward freights:	*Tons.*	
Naval stores	14,000	$255,000
Cotton	400	110,000
Lumber, timber, and cord wood	200,000	400,000
Rice and rice flour	12,000	65,000
Fish, game, and vegetables	50	2,500
Miscellaneous	350	30,000
Total	226,800	862,500
Inward freights: Miscellaneous	16,000	800,000
Grand total	242,800	1,662,500

List of vessels plying Santee River, South Carolina, during calendar year 1904.

Name.	Character.	Length.	Breadth.	Depth.	Gross tonnage.
		Feet.	*Feet.*	*Feet.*	
Eutaw	Side-wheel steamer	156.0	29.8	7.8	547
Gardenia	Stern-wheel steamer	75.0	12.6	3.2	34
Janie	Screw steamer	42.8	10.5	4.5	17
Big Four	do	59.0	14.0	8.0	26
We Go	Schooner	44.0	13.7	4.3	18
Hugh	do	47.6	14.2	3.4	14
Etta	Sloop	47.0	11.0	3.3	8
Flora Temple	do	34.8	12.8	3.3	7
Clipper	do	31.0	11.0	2.9	10
Leilah	do	31.0	10.0	2.5	8
Liza Jane	do	40.8	12.5	4.9	17
Willie	Yacht	40.0	9.0	4.0	6
Loretta	do	40.0	9.0	3.0	7
Pelican	do	30.0	7.0	2.5	3
Thistle	do	43.6	11.5	3.9	13
Emma A. Twiggs	Screw steamer	53.0	13.2	4.5	16

(B) WATEREE RIVER.

No work was done during the year.

It is proposed to apply the available balance and additional appropriation recommended in the purchase of suitable plant for clearing the stream from Camden to its mouth.

Money statement.

July 1, 1904, balance unexpended		$173.39
Amount appropriated by river and harbor act approved March 3, 1905		25,000.00
		25,173.39
June 30, 1905, amount expended during fiscal year, for maintenance of improvement		46.69
July 1, 1905, balance unexpended		25,126.70
July 1, 1905, outstanding liabilities		6.50
July 1, 1905, balance available		25,120.20
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$25,000.00	
For maintenance of improvement	5,000.00	
		30,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

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APPROPRIATIONS.

March 3, 1881	$8,000	August 18, 1894	$2,500
August 2, 1882	15,000	June 3, 1896	5,000
July 5, 1884	5,000	March 3, 1899	2,500
August 5, 1886	7,500	March 3, 1905	25,000
August 11, 1888	12,000		
September 19, 1890	12,500	Total	97,500
July 13, 1892	2,500		

Total expenditures, including June 30, 1905, $72,373.30.

COMMERCIAL STATISTICS, 1904.

There were carried over this stream during the year in rafts 15,600 tons of timber, valued at $29,700.

There were no vessels engaged in the traffic on this stream during the year 1904.

(c) CONGAREE RIVER.

The only work done during the year consisted in removing by a hand force some obstructions under two spans of a railroad bridge near Fort Motte, S. C. The expenditure was $262.69. There were removed 162 obstructions, at a cost of $1.62 per unit. The other expenditures were for setting gauge stakes and for office expenses ($54.78) and for outstanding liabilities ($415.48) for snagging in June, 1904.

About 80 per cent of the approved project had been completed to June 30, 1905.

It is proposed to expend the available balance and appropriation recommended in maintaining a cleared channel and in dredging at shoals.

Money statement.

July 1, 1904, balance unexpended		$857.96
Amount appropriated by river and harbor act approved March 3, 1905		25,000.00
		25,857.96
June 30, 1905, amount expended during fiscal year, for maintenance of improvement		732.95
July 1, 1905, balance unexpended		25,125.01
July 1, 1905, outstanding liabilities		6.50
July 1, 1905, balance available		25,118.51
Amount (estimated) required for completion of existing project		10,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$10,000.00	
For maintenance of improvement	5,000.00	
		15,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

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APPROPRIATIONS.

August 5, 1886	$7,500.00	March 3, 1905	$25,000.00
August 11, 1888	7,500.00		
September 19, 1890	5,000.00	Total appropriations	61,000.00
July 13, 1892	5,000.00	Refunded on account of overpayment	.50
August 18, 1894	4,000.00		
June 3, 1896	2,000.00		
June 13, 1902	5,000.00	Total	61,000.50

Total expenditures, including June 30, 1905, $35,875.49.

COMMERCIAL STATISTICS, 1904.

Article.	Quantity.	Value.
	Tons.	
Outward freights: Timber	42,900	$74,800
Inward freights: Miscellaneous	135	19,100
Total	43,035	93,900

List of vessels plying Congaree River, South Carolina, during calendar year 1904.

Name.	Character.	Length.	Breadth.	Depth.	Gross tonnage.
		Feet.	*Feet.*	*Feet.*	
Janie	Screw tug	42.8	10.5	4.5	17
Sadie	do	35.8	10.2	3.2	8
Highlander	Side-wheel steamer	80.5	25.4	9.2	135

N 5.

IMPROVEMENT OF CONGAREE RIVER, SOUTH CAROLINA, FROM GERVAIS STREET BRIDGE, COLUMBIA, TO GRANBY.

During the year final payment was made to the Evansville Contract Company, the contractors for building the Chanoine movable dam.

The lock gates were hung by hired labor, and the dam has been maneuvered.

The work of clearing the channel above the lock of bowlders and other obstructions has been in progress, using two lighters and a drill float built by hired labor and a gasoline launch bought in open market. The stone removed was placed on shore to protect the abutment.

As the original project called for the construction of a lock and dam, the approved project has been completed.

It is proposed to expend the available balance in clearing the channel, and, as authorized by the river and harbor act approved March 3, 1905, in improving the Congaree River below the lock.

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Money statement.

July 1, 1904, balance unexpended		$87,782.33
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$42,136.27	
Transferred to Congaree River	25,000.00	
		67,136.27
July 1, 1905, balance unexpended		20,646.06
July 1, 1905, outstanding liabilities		942.95
July 1, 1905, balance available		19,703.11

APPROPRIATIONS.

March 3, 1899	$50,000
June 6, 1900	100,000
March 3, 1901	50,000
June 28, 1902	50,000
Total	250,000

Total expenditures, including June 30, 1905, $204,353.94.

EMERGENCY CONTRACT IN FORCE.

Name of contractor: New Jersey Foundry and Machine Company.
Contract for chain.
Price per pound: 4,550 pounds, at 6 cents; 1,650 pounds, at 6¼ cents.
Date of contract: June 30, 1904.
Date of beginning: July 5, 1904.
Date of expiration: August 14, 1904.

There is at present no navigation on this portion of the river.

N 6.

IMPROVEMENT OF THE INLAND WATERWAYS BETWEEN CHARLESTON HARBOR, SOUTH CAROLINA, AND OPPOSITE McCLELLANVILLE.

No work was done during the year, as titles to the lands required for the improvement were not obtained in time. As the titles have now been obtained work will shortly begin.

Money statement.

July 1, 1904, balance unexpended	$50,000.00
July 1, 1905, balance unexpended	50,000.00
July 1, 1905, outstanding liabilities	221.80
July 1, 1905, balance available	49,778.20
Amount (estimated) required for completion of existing project	75,290.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	50,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

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APPROPRIATION.

June 13, 1902 ..... $50,000

COMMERCIAL STATISTICS, 1904.

Articles.	Quantity.	Value.
Toward McClellanville:	*Tons.*	
Fertilizers	1,578	$38,995
Stable manure	487	774
Oysters in shell	8,000	15,000
Miscellaneous, general merchandise, etc	1,297	132,861
Total	11,362	182,570
Toward Charleston:		
Sea Island cotton	189	92,000
Short-staple cotton	68	15,000
Cotton seed	68	984
Hay and grain	88	920
Vegetables	2,441	92,276
Palms	20	550
Lumber	12,000	50,000
Turpentine	500	45,000
Rosin	1,800	30,000
Clams	120	1,600
Oysters—		
In shell	8,931	38,123
Canned	30	15,000
Cord wood	1,394	2,097
Cattle	83	5,000
Miscellaneous	30	3,000
Grand total	39,064	573,770

N 7.

IMPROVEMENT OF HARBOR AT CHARLESTON, SOUTH CAROLINA.

No work was done on the jetties.

The sea-going suction dredge *Charleston* worked the entire year except the time spent in repairs, till May 31, 1905, when she left to work in Winyah Bay. She removed 282,305 cubic yards of material from the inner shoal and 43,405 cubic yards from the outer shoal, a total of 325,710 cubic yards. She worked 205 days during the year, and lost 4 days on account of storm or fog. The rest of the time lost to actual work was consumed in cleaning boilers, Sundays, holidays, and repairs. She was on the marine railway twice during this time, losing 58 working days on this account. She consumed 1,195 tons of coal. The cost of dredging, including office expenses, surveys, and wharfage, was 10 cents per cubic yard.

The seagoing suction dredge *Gen. Abbot* returned to Charleston from Norfolk, Va., on July 24, 1904, and resumed dredging on August 1, 1904. As she was then formally turned over to this office, all the expenditures prior to this date have been treated as the dredge's first cost, as the work she had formerly done was in the nature of a test. This first cost is $191,560.56, as follows:

Cost of dredge Gen. Abbot.

Plans, office expenses, etc., before awarding contract	$1,568.30
Construction, proper	153,427.68
Outfit	7,534.14
Trip from point where built to Charleston, S. C	4,181.13
Expenses during trial	12,406.94
Alterations at Norfolk Navy-Yard	12,442.37
Total	191,560.56

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The *Gen. Abbot* worked at Charleston till May 23, 1905. On May 26 she left for Norfolk, Va., for repairs, where she now is. She removed 263,671 cubic yards of material from the inner shoal and 330,587 cubic yards from the outer shoal, a total of 594,258 cubic yards. She worked 212 days, lost 4 days on account of storm or fog, and lost 119 days on account of repairs, breakdowns, cleaning of boilers, and holidays and Sundays. She used 2,849 tons of coal. The cost of dredging, including office expenses, surveys, and wharfage, was 8.4 cents per cubic yard.

The total quantity removed by both dredges was 919,968 cubic yards.

Some stones dropped in the channel back of Sullivans Island during the construction of the jetties were removed.

The distribution of expenditures during the year was as follows:

Dredging operations, dredge *Charleston*	$29,031.92
Dredging operations, dredge *Gen. Abbot*	42,707.88
Office expenses	4,381.69
Surveys	1,419.07
Wharfage	5,350.64
First cost, dredge *Gen. Abbot*	1,178.46
Miscellaneous	387.94
Total	84,457.60

The following table gives the itemized statement of dredging operations:

Dredge.	Labor.	Subsistence.	Fuel.	Lighting supplies and lubricants.	Repairs.
Charleston	$10,640.16	$2,521.67	$3,777.86	$599.50	[a] $11,490.73
Gen. Abbot	16,046.61	4,185.38	9,298.15	1,340.17	11,095.61

Dredge.	Permanent outfit.	Total.	Cubic yards dredged.	Cost per cubic yard.
				Cents.
Charleston	$2.00	$29,031.92	325,710	8.9
Gen. Abbot	746.96	42,707.88	594,258	7.2

[a] Dredge received two general overhaulings during the year.

Charging one-third of the cost of office expenses, surveys, and wharfage to the *Charleston* and two-thirds to the *Gen. Abbot*, the cost per cubic yard is as follows:

	Cents.
Charleston	10.0
Gen. Abbot	8.4

The annual survey shows that the 26-foot low-water channel is nowhere less than 400 feet wide. For most of the distance it has the project width of 600 feet. Beyond the jetties the channel has the full width, except for a length 1,400 feet, where it is 550 feet wide, and at one other point where it is reduced to 500 feet. Near the inner end of the jetty channel the width is 400 feet.

The project is regarded as completed, as with the removal of a small amount of material the full width will be obtained.

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It is proposed to expend the available balance and the additional appropriation recommended in maintaining the channel and straightening the entrance channel.

Money statement.

July 1, 1904, balance unexpended	$157,094.76
Received from Colonel Quinn rent of dredge, *Charleston*, from Savannah, Ga., office	2,240.00
Received from auction sales	506.96
Amount appropriated by sundry civil act approved March 3, 1905	25,000.00
Amount appropriated by river and harbor act approved March 3, 1905	25,000.00
	209,841.72
June 30, 1905, amount expended during fiscal year, for works of improvement	117,483.37
July 1, 1905, balance unexpended	92,358.35
July 1, 1905, outstanding liabilities	4,015.63
July 1, 1905, balance available	88,342.72
July 1, 1905, amount covered by uncompleted contracts	4,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	25,000.00

APPROPRIATIONS.

June 18, 1878	$200,000.00	March 3, 1903	$60,000.00
March 3, 1879	200,000.00	April 28, 1904	73,000.00
June 14, 1880	170,000.00	March 3, 1905	25,000.00
March 3, 1881	175,000.00	March 3, 1905	25,000.00
August 2, 1882	300,000.00		
July 5, 1884	250,000.00	Total appropriations	4,625,500.00
August 5, 1886	187,500.00		
August 11, 1888	350,000.00	Received for rent of dredge	2,240.00
September 19, 1890	370,000.00		
July 13, 1892	225,000.00	Received account sales at auction	701.96
March 3, 1893	750,000.00		
August 18, 1894	450,000.00	Refunded account overpayment	.28
March 2, 1895	500,000.00		
June 6, 1900	220,000.00	Total receipts	4,628,442.24
June 13, 1902	45,000.00		
June 28, 1902	50,000.00		

Total expenditures, including June 30, 1905, $4,536,083.89.

EMERGENCY CONTRACTS IN FORCE.

Name of contractor.	Contract for—	Price each.	Date of—		
			Contract.	Beginning.	Expiration.
Charleston Terminal Co.	Lease of wharf		May 31, 1904	May 1, 1904	Apr. 30, 1907
New Jersey Car Spring and Rubber Co.	Suction hose	$673	May 7, 1904	May 12, 1904	June 27, 1904
Riverside Iron Works	Cast steel drags	225	Sept. 29, 1904	Oct. 9, 1904	Jan. 9, 1905
Clement Restein & Co	Suction hose	450	Nov. 28, 1904	Dec. 3, 1904	Dec. 28, 1905

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COMMERCIAL STATISTICS.

Arrivals and clearances of vessels and commerce at Charleston, S. C., from January 1 to December 31, 1904.

	Coastwise.			Foreign ports (American vessels).		
	Number.	Tons.	Crew.	Number.	Tons.	Crew.
Arrived	[a]448	1,130,774	26,200	3	2,308	25
Cleared	[b]89	128,007	1,892			

	Foreign ports (foreign vessels).			Total.		
	Number.	Tons.	Crew.	Number.	Tons.	Crew.
Arrived	67	117,372	1,653	518	1,250,454	27,878
Cleared	17	27,296	355	106	155,298	2,247

[a] Of these, 8 vessels, 12,815 tonnage, with crew numbering 173, were foreign.
[b] Of these, 60 vessels, 105,106 tonnage, with crew numbering 1,491, were foreign.

Value of exports	$3,627,390.00
Value of imports	2,472,905.00
Duties collected	41,323.84

American vessels in coastwise trade cleared at custom-house only when bound south out of great district.

Commerce through Charleston Harbor, ocean entrance, calendar year 1904.

IMPORTS.

Articles.	Tons of 2,000 pounds.	Value.	Articles.	Tons of 2,000 pounds.	Value.
Muriate of potash	9,380	$356,440	Coal	82,664	$281,519
Kainit	82,600	608,438	Salt	11,108	77,658
Nitrate of soda	25,905	1,110,206	Rice	4,170	161,120
Sulphate of potash	1,401	61,644	Jute butts	5,659	188,445
Manure salt	9,150	125,430	Refined oil and gasoline	8,571	179,341
Pyrites	61,680	302,885	Fruit	227	11,350
Tankage	2,412	42,800	Cement	20,787	188,248
Fish scrap	13,325	270,959	Bricks and stone	3,322	32,963
Whale meat	945	27,324	Coffee	595	103,018
Guano	20,122	269,625	Hay	179	2,200
Beet refuse	2,598	40,874	Miscellaneous	135,700	13,570,000
Manipulated fertilizers	1,010	25,250			
Phosphate rock	1,019	4,095	Total	505,543	18,218,972
Cotton	1,054	177,140			

EXPORTS.

Lumber	143,246	$709,219	Cotton-seed oil	5,149	$398,172
Phosphate rock	49,245	142,899	Cotton seed	998	12,919
Manipulated fertilizers	4,246	106,150	Cotton-seed meal and cake	3,725	83,000
Fertilizer material	1,197	10,448	Rice	2,348	152,580
Acid phosphate	40,491	254,865	Naval stores	2,250	62,020
Clay	24,601	172,207	Iron	1,767	17,284
Cotton, upland	39,848	6,633,713	Miscellaneous	7,024	364,400
Cotton, sea-island	867	485,696			
Cotton goods	43,884	21,942,000	Total	375,053	31,775,922
Cotton-factory sweepings and lint	4,167	208,350			

These commercial statistics do not include a large part of the business of Charleston which is done by the railroads, nor do they include the commerce passing over the rivers which enter the harbor, nor over the inland routes to the north and south. The commerce to and from Charleston through Wappoo

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Cut amounted to 200,712 tons, valued at $2,639,560, in the calendar year 1904, and through inland waterways to the north, 39,064 tons, valued at $573,770, in the calendar year 1904.

The regular lines of steamships established between this and other ports comprise a total of 15 steamships.

N 8.

IMPROVEMENT OF WAPPOO CUT, SOUTH CAROLINA.

The work during the year consisted in dredging at the Ashley River entrance to restore the previously obtained dimensions of channel, 200 feet wide and 7 feet deep at mean low water, and was entirely for maintenance. Contract was entered into with P. Sanford Ross (Incorporated), Jersey City, N. J., for dredging at 22 cents per cubic yard, scow measurement, and 31,574 cubic yards of material was removed, completing the work. The expenditures during the year were, for dredging, $7,003.13, and for office expenses, $157.11.

By the approval of the Chief of Engineers the project has been modified by the omission of the training walls at the Stono River entrance. The project is regarded as completed.

Money statement.

July 1, 1904, balance unexpended	$7,160.24
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	7,160.24

APPROPRIATIONS.

March 3, 1881	$10,000	July 13, 1892	$10,000
August 2, 1882	10,000	August 18, 1894	7,000
July 5, 1884	3,000	June 3, 1896	2,500
August 5, 1886	5,000	June 13, 1902	8,000
August 11, 1888	5,000		
September 19, 1890	10,000	Total	70,500

Total expenditures, including June 30, 1905, $70,500.

COMMERCIAL STATISTICS, 1904.

Articles.	Quantity.	Value.	Articles.	Quantity.	Value.
	Tons.			*Tons.*	
Rice	7,260	$242,950	Gravel and shell	56,530	$41,321
Vegetables	11,650	337,478	Oysters	311	686
Cotton	1,646	794,530	Clams	90	1,260
Cotton seed	810	10,530	Rice straw	949	7,118
Lumber	78,739	291,744	Miscellaneous	13,739	744,905
Phosphate rock	25,928	75,228			
Manipulated fertilizers	8,060	91,800	Total	200,712	2,639,560

CONTRACT IN FORCE.

Name of contractor: P. Sanford Ross (Incorporated), Jersey City, N. J.
Contract for dredging.
Price: 22 cents per cubic yard.
Date of contract: September 19, 1904.
Date of beginning: October 14, 1904.
Date of expiration: December 30, 1904.

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N 9.

IMPROVEMENT OF INLAND WATERWAY BETWEEN CHARLESTON AND BEAUFORT, INCLUDING WAPPOO CUT, SOUTH CAROLINA.

The work during the year consisted in dredging at both the South Edisto and the Ashepoo ends of the cut, and in removing by wheelbarrows some of the material in the high land near the Ashepoo River.

It was intended to dig the canal with a dipper dredge belonging to the Government, and work began in the soft marsh at the Edisto end in July, the material being first deposited on the banks. As the banks were too soft to hold the weight, a towboat and two dump scows belonging to the Government were used to take the material away. Owing to the caving of the banks, the dredge could load the scows only at high water, and efforts were made with a pile and plank chute on the bank to dredge at low water and deposit the material on the bank at such a distance from the cut that the banks would hold it. As all these efforts proved unsatisfactory, the plant was moved to the Ashepoo River end, where the bank was high and firm and would hold dredged material. As the towboat and scows were needed elsewhere in the district, the material was placed on land. The dredge, however, was not fitted for the work, and after removing by wheelbarrows the material along the cut down to the level of high water the dredge was taken away.

In the meantime contract had been made with P. Sanford Ross (Incorporated), Jersey City, N. J., for dredging in the marsh at 17 cents per cubic yard, scow measurement. The dredge began work June 10, and removed 18,181 cubic yards.

As the river and harbor act approved March 3, 1905, appropriated $20,000 additional for this work, another contract was let to the same firm, P. Sanford Ross (Incorporated), at the same price—17 cents per cubic yard for dredging in the marsh and 20 cents per cubic yard for dredging in the high land.

The project is about 20 per cent completed.

The expenditures during the year were $10,326.26 for removing with the Government dredge 42,446 cubic yards of material, at a cost of 24 cents per cubic yard, $2,663.34 for removing by hired labor 7,279 cubic yards of material, at 36 cents per cubic yard, and $610.70 for office expenses.

The following quantities were removed:

	Cubic yards.
With United States plant at Edisto end	27,581
With United States plant at Ashepoo end	22,144
With contractor's plant at Edisto end	18,181
Total	67,906

It is intended to apply the available balance and additional appropriation recommended in completing the canal to the required dimensions.

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Money statement.

July 1, 1904, balance unexpended	$26,071.53
Amount appropriated by river and harbor act approved March 3, 1905	20,000.00
	46,071.53
June 30, 1905, amount expended during fiscal year, for works of improvement	13,600.30
July 1, 1905, balance unexpended	32,471.23
July 1, 1905, outstanding liabilities	3,165.34
July 1, 1905, balance available	29,305.89
July 1, 1905, amount covered by uncompleted contracts	9,910.00
Amount (estimated) required for completion of existing project	11,600.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	11,600.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

APPROPRIATIONS.

June 13, 1902	$30,000
March 3, 1905	20,000
Total	50,000

Total expenditures, including June 30, 1905, $17,528.77.

EMERGENCY CONTRACT IN FORCE.

Name of contractor: P. Sanford Ross (Incorporated), Jersey City, N. J.
Contract for dredging.
Price: 17 and 20 cents per cubic yard. (The price of 17 cents is for dredging in marsh land; of 20 cents is for dredging in high land.)
Date of contract: March 24, 1905.
Date of beginning: May 24, 1905.
Date of expiration: March 24, 1906.

N 10.

IMPROVEMENT OF BEAUFORT RIVER, SOUTH CAROLINA.

The work during the year consisted in dredging in Brickyard Creek to widen the existing 7-foot channel. Contract was entered into with P. Sanford Ross (Incorporated), Jersey City, N. J., for dredging, at 22 cents per cubic yard, scow measurement, and 7,625 cubic yards were removed, widening the channel to 150 feet. The expenditures during the year were for dredging, $1,769.87, and for office expenses and collecting commercial statistics, $80.63.

By the approval of the Chief of Engineers the present width is regarded as sufficient for the needs of navigation, and the project is regarded as completed.

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Money statement.

July 1, 1904, balance unexpended	$1,850.50
June 30, 1905, amount expended during fiscal year, for works of improvement	1,850.50

APPROPRIATIONS.

September 19, 1890	$12,500
July 13, 1892	12,500
August 18, 1894	5,000
June 3, 1896	1,000
June 13, 1902	2,000
Total	33,000

Total expenditures, including June 30, 1905, $33,000.

CONTRACT IN FORCE.

Name of contractor: P. Sanford Ross (Incorporated), Jersey City, N. J.
Contract for dredging.
Price: 22 cents per cubic yard.
Date of contract: September 19, 1904.
Date of beginning: October 14, 1904.
Date of expiration: December 30, 1904.

COMMERCIAL STATISTICS, 1904.

Articles.	Quantity.	Value.	Articles.	Quantity.	Value.
	Tons.			*Tons.*	
Cotton	236	$91,220	Pyrites	954	$6,678
Cotton seed	663	10,945	Coal	400	1,700
General merchandise	1,475	121,000	Rock screenings	400	
Lumber	238	2,020	Miscellaneous	150	1,500
Oysters in cans	165	18,000			
Oysters in the shell	2,425	12,125	Total	7,881	286,350
Oyster shells	775	1,162			

Number and class of vessels that have navigated that portion of Beaufort River known as Brickyard Creek during calendar year 1904.

Kind.	Number.	Total tonnage.	Number single trips.
Pilot boats	2	180	40
Tugboats	4	200	50
Yachts	40	4,000	150
Schooners[a]	8	5,600	8
Lighters	10	1,000	50
Dredge	1	150	2
Revenue cutter	1	500	2
Passenger boats[b]	2	600	100
Coasters, or small schooners	20	600	500

[a] Three and four masted.
[b] Steamboats carrying during the year 2,500 passengers.

A large number of small craft ply the above-named creek.

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N 11.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

An allotment of $2,000 was made during the previous fiscal year for removing the wreck of an old vessel (*Agostino C.*), which had been converted into a phosphate barge and which was wrecked in Ashley River, near Lambs, S. C. The wreck had been removed by dynamite and Government plant to a depth of about 14 feet at low water, which is sufficient for the navigation of the river, with the exception of a small portion. In removing this portion during the present year a number of submerged logs were encountered and an additional allotment of $500 was made. The work has been completed.

An allotment of $15,000 has been made for removing the wreck of the schooner *Kate V. Aitken* from the jetty channel, Charleston Harbor, South Carolina. Bids were invited for the removal, which will be opened July 20, 1905.

No expenditures have been made.

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APPENDIX O.

IMPROVEMENT OF RIVERS AND HARBORS IN EASTERN GEORGIA, OF INSIDE WATER ROUTE BETWEEN SAVANNAH, GEORGIA, AND FERNANDINA, FLORIDA, AND OF CUMBERLAND SOUND, GEORGIA AND FLORIDA.

REPORT OF LIEUT. COL. JAMES B. QUINN, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1905, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Savannah Harbor, Georgia.
2. Savannah River below Augusta, Georgia.
3. Savannah River above Augusta, Georgia.
4. Harbor at Darien and Doboy bar, Georgia.
5. Altamaha River, Georgia.
6. Oconee River, Georgia.
7. Ocmulgee River, Georgia.
8. Brunswick Harbor, Georgia.
9. Inside water route between Savannah, Georgia, and Fernandina, Florida.
10. Skidaway Narrows, Georgia.
11. Cumberland Sound, Georgia and Florida.
12. Removing sunken vessels or craft obstructing or endangering navigation.

UNITED STATES ENGINEER OFFICE,
Savannah, Ga., July 19, 1905.

GENERAL: I have the honor to transmit herewith my annual report for the fiscal year ending June 30, 1905, upon the works of river and harbor improvements in my charge.

Very respectfully,

JAMES B. QUINN,
Lieut. Col., Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

O 1.

IMPROVEMENT OF SAVANNAH HARBOR, GEORGIA.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1905.

For a detailed history of the work, see reports of the Chief of Engineers for 1903, pages 1146–1152, and for 1904, pages 1644–1647.

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DREDGING.

Dredging under contract of November 14, 1902, with P. Sanford Ross, Incorporated, of Jersey City, N. J., was continued until January 6, 1905, when the work was completed. There were removed during the fiscal year, under this contract, 280,590.8 cubic yards of material. There were also removed by this contractor, during the fiscal year, in a redredging of the channel at Long Island Crossing, under supplemental agreement of May 20, 1904, 293,077.8 cubic yards of material. This work was completed December 1, 1904; the total amount removed being 298,851.4 cubic yards.

The total quantity of material removed under the above two contracts was 2,584,449.9 cubic yards.

Under contract of November 21, 1902, with Atlantic, Gulf and Pacific Company, of New York, there were dredged during the fiscal year 950,296 cubic yards of material. All work under this contract was completed on April 25, 1905, the total quantity of material removed thereunder being 2,646,889.8 cubic yards.

The total work done under the foregoing contracts was 5,231,339.7 cubic yards, which completed all inside dredging provided for to give a channel 28 feet deep at mean high water, from the old waterworks above the city to the sea.

Bids for the dredging of 175,000 cubic yards from "Upper and Lower Flats" and "Obstructions" channels, so as to restore the project depth of 28 feet at mean high water, previously obtained at those places, were opened June 30, 1905, and the bid of George W. Catt, of New York, N. Y., at 17.4 cents per cubic yard, was recommended for approval.

During the months of November and December, 1904, the U. S. dredge *Cumberland* removed from the Tybee Knoll channel 99,214 cubic yards of material, at a cost of 6.7 cents per cubic yard.

On March 5, 1905, the U. S. dredge *Savannah*, built under direction of Maj. J. C. Sanford, Corps of Engineers, for work in this harbor, arrived, and after undergoing repairs to her steering gear, started work on Tybee Knoll and the outer bar on March 21. Between this latter date and June 30, 1905, this dredge removed a total of 107,030 cubic yards, at a cost of 14.4 cents per cubic yard. Practically all of this material was removed from Tybee Knoll. This boat has been greatly handicapped in her work, owing to the making of necessary repairs and alterations to put her in first-class working order. It is expected that she will make a much better showing from now on. A record of the working of this dredge from March 21 to June 30, 1905, is as follows:

	March.	April.	May.	June.
	Days.	*Days.*	*Days.*	*Days.*
At work	9	15	18½	12½
Time lost:				
Sundays	1	5	4	4
Holidays			1	
Cleaning boilers		2	2	
Rough weather and fog	1	1	2	
Undergoing repairs and alterations		7	3½	12½
Other causes				1
Total time lost	2	15	12½	17½

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	March.	April.	May.	June.
Total time consumed in loading.....hours and minutes..	53.54	35.43	62.43	35.32
Total time consumed in dumping.....do....	46.00	84.38	109.01	98.19
Total distance to and from dump ground.....miles..	140	523	618	640
Total number of loads made.....	23	41	52	36

Cost of operating.	March.	April.	May.	June.
Labor.....	$1,484.51	$1,532.17	$1,578.82	$1,564.32
Subsistence.....	367.65	554.40	566.99	499.00
Coal.....	465.02	991.48	548.23	626.13
Oils.....	48.75	19.80	.....	10.60
Minor repairs.....	25.00	336.16	1,239.84	437.01
Miscellaneous.....	280.36	167.03	1,007.46	676.03
Total.....	2,671.29	3,601.04	4,941.34	3,813.59

	March.	April.	May.	June.
Amount of material removed.....cubic yards..	12,797	29,361	35,632	29,240
Cost.....cents per cubic yard..	20.85	12.3	13.8	13.4

NOTE.—Cost of general repairs, amounting to $5,021.58, not included in computing cost per cubic yard of material dredged.

COALING WHARF.

A coaling and mooring wharf for United States dredges was constructed at the Venus Point mooring dolphin, 10½ miles below the city, under contract with D. Power & Co., of Savannah, Ga., dated December 29, 1904, the work being completed May 13, 1905. A portion of the eastern end of the dolphin was decked over and a platform, on cement pillars, for the storage of coal, was built on the marsh immediately in rear of the dolphin. An overhead runway, hoisting engine, and derrick, for handling coal, were installed. A small storehouse was constructed for the storage of coal carts, broken and spare parts of dredges, etc., and an artesian well for supplying water was sunk.

JETTY WORK.

Repairs to jetties, begun during the previous fiscal year, under contract of January 2, 1904, with Simons-Mayrant Company, of Charleston, S. C., were continued until July 18, 1904, when the work was completed. During the past fiscal year a total of 1,651.46 cubic yards of stone were placed on the jetties, making the total quantity of stone placed under the contract 12,051.35 cubic yards.

By authority of the Chief of Engineers, dated January 4, 1905, (26179–10), Mr. P. Sanford Ross, of Jersey City, N. J., was ordered to close a gap in Dam No. 31 which he was permitted to make for use as an entrance to dumping ground during the progress of his contract of October 20, 1892, for dredging in this harbor. The work of closing the gap was begun the latter part of February, 1905, and completed March 11, 1905. The $10,000 which had been retained to insure the proper closing of this gap was paid over to Mr. Ross, except $50 deducted for cost of superintendence and inspection.

A complete resurvey of the harbor with a view to securing a channel depth of 26 feet at mean low water was made, as provided for by

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the river and harbor act of March 3, 1905, and at the close of the fiscal year the plotting of same was well under way. A number of survey stations were built and nine concrete bench marks installed where old bench marks were in danger of being destroyed.

A new hull for the U. S. steamer *Angler* was constructed under contract with the Riverside Iron Works, of Charleston, S. C., dated September 1, 1904, the same being completed June 28, 1905. The machinery was transferred from the old boat, which latter it is proposed to fit up for use as a quarter boat for survey parties.

The self-registering tide gauges in the harbor were kept up during the fiscal year. From the records from these gauges for the fiscal years 1903 to 1905, inclusive, the new planes of high and low water between the old waterworks and Fort Pulaski, which have been produced by the extensive dredging done during that period, have been determined and are shown in comparison with the high and low water planes existing in 1894–95 on the diagram herewith.

CONDITION OF WORK JUNE 30, 1905.

At the close of the fiscal year all of the dredged cuts inside of Tybee Knoll had the full project depth and width except "Upper and Lower Flats" and "Obstructions" channels, and the channel at the extreme upper end of the city. At the "Obstructions," shoaling has taken place at the point where the water is drawn off by the south channel, where for a distance of about 1,000 feet the channel has shoaled up about 1.5 feet, leaving a low-water depth of about 20 feet. At the "Upper Flats" the channel has shoaled up about 2.5 feet, leaving a low-water depth at that place of about 19 feet for a distance of nearly 2,000 feet. At the "Lower Flats" only a slight shoaling has occurred. From a point opposite the old waterworks, above the city, and extending for a distance of about 1,600 feet downstream, the channel has shoaled up to about 18 feet at mean low water. The shoaling of this channel, however, does not interfere with navigation, as deep-draft vessels have no occasion to use the same at present. The material at the "Upper and Lower Flats" and "Obstructions" being very soft mud, the shoaling which has occurred at those places is causing no immediate inconvenience to shipping. The project depth of 28 feet at mean high water will be restored at these localities within the next four or five months.

The work done by Government dredges on Tybee Knoll has resulted in an increase in the controlling depth of 2 feet over that existing June 30, 1904, which was 18 feet at mean low water. As only a small amount of work has been done, however, the channel is very narrow, ranging from 75 to 150 feet in width. On the outer bar the controlling depth is 19 feet at mean low water. The mean rise of tide on Tybee Knoll is 6.75 feet, and on the outer bar, 7 feet.

At the close of the fiscal year the project was about 68 per cent completed.

The available balances and additional appropriations recommended will be applied toward the completion of all dredging provided for under the present project.

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COMMERCE AND NAVIGATION.

Full discussions of the commerce of Savannah were given in the Reports of the Chief of Engineers for 1890, pages 1252 and 1253, and for 1897, page 1497.

The regular lines of steamships established between this port and New York, Boston, Baltimore, and Philadelphia comprise a total of 16 steamers. During the calendar year 1904, 9 of these ran to the two first-named ports and 7 to the last-named two. During the year they made 476 round trips and carried 929,267 tons of freight. They also handled in and out of Savannah 24,347 passengers.

On the inland waters there are a number of small steamers plying between Savannah and adjacent ports, besides numerous schooners and small sailboats. It is estimated that for the year 1904 this portion of the commerce amounted to 100,000 tons, valued at $1,500,000.

The chief articles of export are cotton, lumber, and naval stores, of which the shipments for the year 1904 were as follows: Of cotton, 1,135,325 bales; of lumber, 151,039,158 feet; and of naval stores, 176,626 barrels of turpentine and 636,832 barrels of rosin.

The total tonnage of the port, inward and outward bound, coastwise and local, during 1904 was 3,230,346 tons, valued at $193,820,760. This is an increase over 1903 of 302,320 tons. In this connection it may be stated that the receipts of cotton at this port for the season 1904–5 had reached, up to June 30, 1905, 1,739,420 bales, which is 571,229 bales more than the receipts for the entire season of 1903–4, which amounted to 1,168,191 bales.

Of the total amount expended during the fiscal year, $137,747.01 was for dredging under contract with P. Sanford Ross (Incorporated), at 17.5 cents per cubic yard; $179,174.82 for dredging under contract with Atlantic, Gulf and Pacific Company, at 16.9 cents per cubic yard; $9,950 for closing gap in Dam No. 31, being the amount withheld from P. Sanford Ross for dredging done under contract of October 20, 1892, less cost of superintendence, $50; $4,762.66 for constructing mooring dolphins under contract; $16,914.93 for repairs to training walls, under contract; $297.50 deposited on account of rental of U. S. dredge *Cape Fear;* $3,135.23 for construction of coaling wharf under contract; $6,649.95 for dredging with U. S. dredge *Cumberland*, at 6.7 cents per cubic yard; $12,377.94 for dredging with U. S. dredge *Savannah*, at 14.4 cents per cubic yard; and $5,021.58 for general repairs to dredge *Savannah;* $1,839.50 for construction of new hull for U. S. steamer *Angler* under contract; and $30,505.99 for contingencies.

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Money statement.

July 1, 1904, balance unexpended		$317,497.62
Amounts received from proceeds of Government property		10.00
Amount appropriated by sundry civil act approved March 3, 1905		175,000.00
Amount appropriated by river and harbor act approved March 3, 1905		75,000.00
		567,507.62
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$332,513.23	
For maintenance of improvement	75,863.88	
		408,377.11
July 1, 1905, balance unexpended		[a] 159,130.51
July 1, 1905, outstanding liabilities		7,343.53
July 1, 1905, balance available		151,786.98
Amount (estimated) required for completion of existing project		210,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$210,000.00	
For maintenance of improvement	100,000.00	
		310,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

AMOUNT AND DATE OF ALL APPROPRIATIONS.

From 1826 up to the date of the 22-foot plan of improvement appropriations amounting to $667,096.64 were made for the improvement of the harbor and for the removal of wrecks, as follows:

March 18, 1826	$50,000.00	August 30, 1852	$40,000.00
March 3, 1829	24,490.00	March 3, 1855	161,000.00
July 3, 1832	25,000.00	June 10, 1872	50,000.00
March 2, 1833	43.06	March 3, 1873	50,000.00
March 2, 1833	8,430.62	February 27, 1874	193,132.96
June 28, 1834	30,000.00		
March 3, 1835	20,000.00	Total	667,096.64
July 7, 1838	15,000.00		

Under the 22-foot plan of improvement the following appropriations were made:

June 23, 1874	$50,000.00	August 5, 1886	$150,000.00
March 3, 1875	70,000.00	August 11, 1888	180,000.00
August 14, 1876	62,000.00		
June 18, 1878	70,000.00		1,212,000.00
March 1, 1879	100,000.00	Unexpended balance of last appropriation carried to new project	4,035.05
June 14, 1880	65,000.00		
March 3, 1881	65,000.00	Total	1,207,964.95
August 2, 1882	200,000.00		
July 5, 1884	200,000.00		

	1,212,000.00
Unexpended balance of last appropriation carried to new project	4,035.05
Total	1,207,964.95

[a] $200,000 are disbursed by Major Sanford.

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WATER

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Under the 26-foot plan of improvement the following appropriations have been made:

By act of Congress of—		
August 11, 1888 (unexpended balance)		$4,035.05
September 19, 1890		350,000.00
July 13, 1892		318,750.00
March 3, 1893		1,000,000.00
August 18, 1894		975,000.00
March 2, 1895		856,250.00
		3,504,085.05
Amount deposited by clerk of United States circuit court for the southern district of Georgia, March 20, 1895		500.00
		3,504,535.05
Unexpended balance of last appropriation carried to modified project		44,485.06
Total		3,460,049.99

Under the modified 26-foot project for improving Savannah Harbor the following appropriations have been made:

By act of Congress of—		
March 2, 1895 (unexpended balance)		$44,485.06
June 3, 1896		5,000.00
June 4, 1897		350,000.00
July 1, 1898		450,000.00
March 3, 1899	$200,000.00	
	50,000.00	
		250,000.00
June 13, 1902		50,000.00
		1,149,485.06
Amount deposited to credit of the appropriation		301.41
Total		1,149,786.47
Unexpended balance of last appropriations carried to new project		436,867.63
Total		712,918.84

Under the 28-foot plan of improvement the following appropriations have been made:

By act of Congress of—		
June 13, 1902 (unexpended balance from last appropriation)		$436,867.63
March 3, 1903		720,000.00
June 6, 1900 (allotted from emergency appropriation)		5,000.00
April 28, 1904		105,000.00
March 3, 1905, river and harbor act	$75,000.00	
March 3, 1905, sundry civil act	175,000.00	
		250,000.00
		1,516,867.63
Amount received from "Proceeds of Government property" November 12, 1902		75.00
Amount received from "Proceeds of Government property" October 21, 1904		10.00
Total		1,516,952.63
Grand total		7,564,983.05

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CONTRACTS IN FORCE.

Name and address of contractor.	Amount and character of work.	Rate per cubic yard.	Date of approval.	Work begun.	Expires.
P. Sanford Ross (Incorporated), Jersey City, N. J.[a]	Dredging 2,800,000 cubic yards.	$0.175	Dec. 15, 1902	Jan. 6, 1903	Aug. 16, 1904
Atlantic, Gulf and Pacific Co., New York, N. Y.[b]	Dredging 3,310,000 cubic yards.	.169	Dec. 11, 1902	Feb. 15, 1903	Oct. 6, 1904
Symons-Mayrant Co., Charleston, S. C.[c]	Repairs to training walls, 12,000 cubic yards of stone.	2.68	Jan. 25, 1904	Mar. 29, 1904	Sept. 29, 1904
		Amount of contract.			
Riverside Iron Works, Charleston, S. C.[d]	Construction of new hull for U. S. S. Angler and installation of machinery therein.	$10,575	Sept. 16, 1904	Oct. 1, 1904	Mar. 1, 1905
D. Power & Co., Savannah, Ga.[e]	Constructing coaling wharf for United States dredges.	3,241	Jan. 10, 1905	Feb. 16, 1905	Apr. 13, 1905

[a] Extended; no specific date fixed. Completed January 6, 1905.
[b] Extended; no specific date fixed. Completed April 25, 1905.
[c] Completed July 18, 1904.
[d] Extended; no specific date fixed. Completed June 28, 1905.
[e] Extended; no specific date fixed. Completed May 13, 1905.

COMMERCIAL STATISTICS.

Cotton statistics of the port of Savannah, Ga., for the commercial year ending August 31, 1904, are as follows:

Receipts from all sources.

Grade.	Quantity.	Weight.	Value.
	Bales.	*Pounds.*	
Upland	1,116,849	562,970,075	$63,325,338
Sea island	51,342	19,652,690	4,632,075
Total	1,168,191	582,622,765	67,957,413

Destination.	Upland.	Sea island.
	Bales.	*Bales.*
Coastwise	280,311	28,075
Great Britain	167,302	13,735
France	50,816	5,483
Other continental ports	589,801	802
Local consumption	2,023	----------
Reshipped to interior	18,273	1,490
Total	1,108,526	49,585

Total exports.

Grade.	Foreign exports.	Coastwise exports.	Total.
	Bales.	*Bales.*	*Bales.*
Upland	807,919	280,311	1,088,230
Sea island	19,020	28,075	47,095
Total	826,939	308,386	1,135,325

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Cotton receipts at Savannah, season of 1903–4.

Number of bales 1,168,191

Receipts of naval stores at the port of Savannah, season of 1904–5.

Spirits of turpentine ..... casks.. 175,531
Rosin ..... barrels.. 617,617

Arrivals and clearances of vessels and commerce at Savannah, Ga., from January 1 to December 31, 1904.

	Coastwise.			Foreign ports.						Total.			Greatest draft.
				American vessels.			Foreign vessels.						
	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	
													Ft. In.
Arrived	607	1,244,537	24,429	9	5,283	79	102	160,101	2,484	718	1,409,921	26,992	25 5
Cleared	512	1,024,991	21,296	3	1,537	25	196	372,059	5,338	711	1,398,587	26,659	25 6

Commerce (foreign).

Value of exports $61,372,317.00
Value of imports 973,343.00
Duties collected 34,804.07

O 2.

IMPROVEMENT OF SAVANNAH RIVER, GEORGIA, BELOW AUGUSTA.

At the close of the fiscal year the project depth can be carried from Savannah to Augusta, except at two or three places near Augusta, where the controlling depth at an ordinary stage of summer low water is 3 feet.

As the total amount estimated in the project for the improvement of this stream has been appropriated, and as further training dikes and shore protections are absolutely necessary, a new project of improvement will be required to carry on the work.

It is estimated that for the completion of the project, as approved in 1890, there will be required the further sum of $75,000 in addition to the amount required for maintenance.

It is further recommended that a survey of the river be made with a view to providing a permanent system of improvement by locks and dams for the upper portion of the river, just below Augusta. It is estimated that this survey will cost $5,000.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1905.

Snagging operations were carried on by the snag boat *Tugaloo* from August 22, 1904, to May 17, 1905. During this time there were removed from the channel 3,595 snags, 245 stumps, and 4 small barges; 1,382 overhanging trees and 77 logs were cut on the banks; 17 trees on banks girdled, and 1 clay bank removed.

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A contract was entered into on June 20, 1905, with A. J. Twiggs, of Augusta, Ga., for the construction of training and shore-protection dikes at Tweedys bar and Sand Bar Ferry.

The amount expended during the fiscal year was $11,774.21, of which $247.20 was for contingencies; the balance for snagging work.

At the close of the fiscal year the approved project was about 75 per cent completed.

It is proposed to apply available balances and additional appropriations recommended to keeping the channel cleared of obstructions and the construction of additional training and shore-protection dikes in the 25 miles of river just below Augusta.

COMMERCE AND NAVIGATION.

A detailed statement of the sources of the commerce of this river is given on page 1331 of the Annual Report of the Chief of Engineers for 1890, and on page 1504 of the Report for 1897.

During the calendar year 1904 there were 7 steamers engaged in river traffic, making 350 round trips between Savannah and Augusta and between Augusta and Hirshmans Lake, 125 miles below Augusta, and carrying 61,353 tons of freight, valued at $6,154,521.

There were also received at Savannah from this river, in small boats and lighters, 107,000 bushels of rice, valued at $82,600.

During the same year 28,430,400 feet B. M. of timber was rafted down the river, valued at $330,110.

Money statement.

July 1, 1904, balance unexpended		$6,616.45
Amount appropriated by river and harbor act approved March 3, 1905		13,000.00
Amount allotted from appropriation for maintenance of river and harbor improvements, act of April 28, 1904		5,000.00
Amount received from proceeds of sale of property		15.00
		24,631.45
June 30, 1905, amount expended during fiscal year, for maintenance of improvement		11,774.21
July 1, 1905, balance unexpended		12,857.24
July 1, 1905, outstanding liabilities		51.00
July 1, 1905, balance available		12,806.24
July 1, 1905, amount covered by uncompleted contracts		6,220.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$70,000.00	
For maintenance of improvement	4,000.00	
		74,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

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AMOUNT AND DATE OF ALL APPROPRIATIONS.

Under the original project for improvement of the Savannah River, adopted in 1880, the following appropriations were made:

By act of Congress of—	
March 3, 1881	$15,000.00
August 2, 1882	25,000.00
July 5, 1884	15,000.00
August 5, 1886	15,000.00
August 11, 1888	21,000.00
	91,000.00
Unexpended balance from last appropriation, carried to new project	19.91
Total	90,980.09
Received from other appropriations for use of snag boat	2,500.00
Aggregate	93,480.09

Since the existing project for improving the Savannah River was adopted the following appropriations have been made for this work:

By act of Congress of—	
August 11, 1888 (balance unexpended)	$19.91
September 19, 1890	25,000.00
July 13, 1892	35,000.00
August 18, 1894	15,000.00
June 3, 1896	15,000.00
March 3, 1899	20,000.00
June 6, 1900	64,000.00
March 3, 1901	100,000.00
June 28, 1902	86,000.00
November 11, 1904 (allotted from emergency appropriation)	5,000.00
March 3, 1905	13,000.00
Total	378,019.91
Amount received from "Proceeds of Government property," November 12, 1902	50.00
Amount received from "Proceeds of Government property," October 21, 1904	15.00
	378,084.91
Grand total	471,565.00

O 3.

IMPROVEMENT OF SAVANNAH RIVER ABOVE AUGUSTA, GEORGIA.

The Savannah River above Augusta is navigable only by pole boats from the locks 7 miles above the city of Augusta to Petersburg, a distance of 48 miles.

So far as is known no deterioration of the channel has taken place during the past year, though it is probably very much obstructed by snags, no work having been done for the past six years. The channel is a difficult one, and $5,000 can be profitably expended in its improvement during the fiscal year ending June 30, 1907.

No work was done during the past fiscal year.

The project is about 50 per cent completed.

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It is proposed to apply available balances and additional appropriation recommended toward the removal of obstructions and the widening and straightening of the channel.

COMMERCE AND NAVIGATION.

A detailed statement of the commerce tributary to this river is given in a report on the examination and survey of the river, printed as House Executive Document No. 213, Fifty-first Congress, first session.

The freight carried on the river consists of cotton, grain, fertilizers, and general merchandise. In 1904 it amounted to about 1,094 tons, valued at $119,802.41.

Money statement.

July 1, 1904, balance unexpended	$64.45
Amount appropriated by river and harbor act approved March 3, 1905	2,000.00
July 1, 1905, balance unexpended	2,064.45
Amount (estimated) required for completion of existing project	11,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	5,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

AMOUNT AND DATE OF ALL APPROPRIATIONS.

Under the original project of improvement of Savannah River above Augusta, adopted in 1879, the following appropriations were made:

By act of Congress of—	
June 14, 1880	$16,000
March 3, 1881	8,000
August 2, 1882	15,000
Total	39,000

Since the existing project for improving this portion of Savannah River was adopted the following appropriations have been made for this work:

By act of Congress of—	
July 13, 1892	$10,000
August 18, 1894	6,000
June 3, 1896	3,000
March 3, 1899	1,000
March 3, 1905	2,000
Total	22,000

O 4.

IMPROVEMENT OF HARBOR AT DARIEN AND DOBOY BAR, GEORGIA.

Darien Harbor is constituted by that portion of Darien River between the town of Darien and Doboy Sound. Doboy bar constitutes the nearest ocean entrance to Darien Harbor and the Altamaha

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River. These two works were consolidated by the act of Congress approved June 13, 1902.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1905.

The work of repairing and extending spur dams in Darien Harbor was resumed October 11, 1904, and completed March 20, 1905, the work being done by hired labor, with use of Government plant. During this period 2,340 linear feet of old dam was refilled with brush fascines and stone and 250 linear feet of new work constructed, the quantities of materials placed being 8,657 cubic yards of brush fascines, 532.3 cubic yards of stone, 142 piles, and 458 cross-ties.

A complete survey of Darien Harbor was made during August, 1904.

Dredging work was begun in Darien Harbor on March 13, 1905, by P. Sanford Ross (Incorporated), of Jersey City, N. J., under contract dated February 11, 1905, and at the close of the fiscal year 96,482.7 cubic yards of material and 85 logs, encountered in dredging, had been removed.

A survey of Doboy bar was made during August, 1904. On January 3, 1905, bids for dredging the projected channel across the bar were advertised for. The lowest bid received was 35 cents per cubic yard, which was rejected as being excessive. It has been decided to do the necessary dredging on this bar with the U. S. dredge *Savannah*.

The approved project for the improvement of Darien Harbor was practically completed at the close of the fiscal year, there remaining only about 5,000 cubic yards of material to be removed to give a channel 12 feet deep at mean low water throughout the harbor. No part of the approved project for Doboy bar has been accomplished.

ALLOTMENTS.

On November 23, 1904, $26,865.96 was allotted for dredging and for repairs to spur dams in Darien Harbor, and $28,000 for dredging on Doboy bar.

The total amount expended during the fiscal year was $23,177.87, of which $9,890.05 was for dredging, $8,572.75 for repairs to spur dams, and $2,671.52 for surveys and contingencies, Darien Harbor, and $1,293.55 for surveys and contingencies, and $750 for new hull for U. S. steamer *Angler*, Doboy bar.

It is proposed to apply available balances and additional appropriations recommended for maintaining the project depth in Darien Harbor by dredging, and for obtaining the projected channel across Doboy bar by the use of Government dredge.

COMMERCE AND NAVIGATION.

The commerce of Darien consists almost entirely of timber. A small product of rice and naval stores is shipped from that point. A daily steamer runs to Brunswick. The bulk of the timber passing through Darien Harbor from the Altamaha River will probably cross Doboy bar when the improvement is complete. When the timber is

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gone, which is a matter of comparatively a few years, the commerce will probably greatly decrease.

In 1904 the commerce of Darien Harbor amounted to 121,224 tons, valued at $917,240.

Money statements.

DARIEN HARBOR.

July 1, 1904, balance unexpended		$5,959.94
Amount allotted from appropriation for improving harbor at Darien and Doboy bar, Georgia		26,865.96
		32,825.90
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$7,561.57	
For maintenance of improvement	13,572.75	
		21,134.32
July 1, 1905, balance unexpended		11,691.58
July 1, 1905, outstanding liabilities		4,397.83
July 1, 1905, balance available		7,293.75
July 1, 1905, amount covered by uncompleted contracts		653.80
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905		8,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

DOBOY BAR.

July 1, 1904, balance unexpended		$2,000.00
Amount allotted from appropriation for improving harbor at Darien and Doboy bar, Georgia		28,000.00
		30,000.00
June 30, 1905, amount expended during fiscal year, for works of improvement		2,043.55
July 1, 1905, balance unexpended		27,956.45
July 1, 1905, balance available		27,956.45

CONSOLIDATED.

July 1, 1904, balance unexpended		$62,825.90
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$9,605.12	
For maintenance of improvement	13,572.75	
		23,177.87
July 1, 1905, balance unexpended		39,648.03
July 1, 1905, outstanding liabilities		4,397.83
July 1, 1905, balance available		35,250.20
July 1, 1905, amount covered by uncompleted contracts		653.80
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905		8,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

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AMOUNT AND DATE OF ALL APPROPRIATIONS.

Previous to the existing project there was appropriated for Darien Harbor:

By act of Congress, June 18, 1878	$8,000.00

Since the existing project for improving this work was adopted the following appropriations have been made:

September 19, 1890	$25,000.00
July 13, 1892	25,000.00
August 18, 1894	25,000.00
June 3, 1896	20,000.00
March 3, 1899	10,000.00
From the appropriation of $30,000, Darien Harbor and Doboy bar, June 13, 1902, there has been allotted, November 7, 1902	24,000.00
Amount allotted November 23, 1904	26,865.96
Total	155,865.96
Amount received from appropriation for Cumberland Sound, Georgia and Florida	1,500.00
	157,365.96
Grand total	165,365.96

Previous to the existing project there was appropriated for Doboy bar:

By act of Congress, August 5, 1886	$5,795.40

Since the existing project for this work was adopted there was the following appropriation made:

March 3, 1899	$70,000.00
Unexpended balance carried to consolidated appropriation for improving harbor at Darien and Doboy bar	50,865.96
Total	19,134.04
Amount allotted December 23, 1903	2,000.00
Amount allotted November 23, 1904	28,000.00
Total	49,134.04
Grand total	54,929.44
Aggregate of appropriations for Darien Harbor and Doboy bar	220,295.40

CONTRACT IN FORCE.

Contractor: P. Sanford Ross (Incorporated), Jersey City, N. J.
Character of work: Dredging.
Rate: 11.85 cents per cubic yard.
Date of approval: February 17, 1905.
Work begun: March 13, 1905.
Expires: July 15, 1905.

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COMMERCIAL STATISTICS.

Arrivals and clearances of vessels at Darien, Ga., from January 1 to December 31, 1904.

	Coastwise.			Foreign ports.						Total.		
				American vessels.			Foreign vessels.					
	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.
Arrived	40	29,718	480	.....	.....	.....	22	29,619	427	62	59,337	907
Cleared	23	9,544	173	.....	.....	.....	37	50,073	748	60	59,617	921

Timber shipments from port of Darien, Ga.

Year.	Foreign.		Coastwise.		Total.	
	Superficial feet.	Value.	Superficial feet.	Value.	Superficial feet.	Value.
Jan. 1 to Dec. 31, 1904	50,352,111	$646,692	9,385,605	$168,948	59,737,716	$815,640

Commerce.

Value of exports and imports (coastwise and foreign) $917,240.00
Total collections 1,825.55

O 5.

IMPROVEMENT OF ALTAMAHA RIVER, GEORGIA.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1905.

One hundred and five snags, 4 stumps, and 4 logs were removed from the river channel.

The steam hoister and pile driver *Sapelo* and pile driver *No. 2* were thoroughly overhauled and towed to Town Bluff Shoal, 2 miles below the Forks, and at the close of the fiscal year were ready to begin the excavation of rock at that place.

It is proposed to apply available balances and additional appropriation recommended to the removal of snags, stumps, etc., the cutting of overhanging trees, and the removal of sand bars and rock shoals.

The amount expended during the fiscal year was, for snagging work, $968.13, and for care and repairing of plant, $1,003.09. These sums include contingencies.

Many of the old works of improvement require repairs, several rock shoals need to be removed, additional training dikes are required, and numerous snags and overhanging trees should be removed.

The proportion of the approved project accomplished up to June 30, 1905, is about 45 per cent.

COMMERCE AND NAVIGATION.

The principal items of commerce of the river are timber and naval stores and the merchandise necessary to supply the camps of the producers of those articles.

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During the calendar year 1904, 109,255,356 feet B. M. of timber were rafted down the river, valued at about $1,348,986. The majority of this timber came from the Oconee and Ocmulgee rivers, and was rafted down the Altamaha to mills at Darien and vicinity. About 49,000,000 feet, valued at about $539,000, originated on the Altamaha.

There were also handled about 4,500 tons of freight, valued at about $200,000.

Money statement.

July 1, 1904, balance unexpended	$2,831.87
Amount appropriated by river and harbor act approved March 3, 1905	10,000.00
	12,831.87
June 30, 1905, amount expended during fiscal year, for works of improvement	1,971.22
July 1, 1905, balance unexpended	10,860.65
July 1, 1905, outstanding liabilities	2,101.23
July 1, 1905, balance available	8,759.42
Amount (estimated) required for completion of existing project	104,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:	
For works of improvement $30,000.00	
For maintenance of improvement 10,000.00	
	40,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

AMOUNT AND DATE OF ALL APPROPRIATIONS.

Under the original project of improvement of the Altamaha River, adopted in 1880, the following appropriations were made:

By act of Congress of—	
March 3, 1881	$5,000.00
August 2, 1882	15,000.00
July 5, 1884	20,000.00
August 5, 1886	20,000.00
August 11, 1888	10,000.00
	70,000.00
Unexpended balance of last appropriation carried to new project	223.41
Total	69,776.59

Since the existing project for improving Altamaha River was adopted, in 1890, the following appropriations have been made for this work:

By act of Congress of—	
August 11, 1888 (unexpended balance)	$223.41
September 19, 1890	15,000.00
July 13, 1892	15,000.00
August 18, 1894	10,000.00
June 3, 1896	10,000.00
March 3, 1899	6,000.00
June 6, 1900 (allotted from emergency appropriation)	9,000.00
June 13, 1902	10,000.00
March 3, 1905	10,000.00
Total	85,223.41
Grand total	155,000.00

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O 6.

IMPROVEMENT OF OCONEE RIVER, GEORGIA.

This river is tributary to the Altamaha River.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1905.

At the urgent request of owners of steamboats operating on this river, an effort was made during the month of July, 1904, to send the snag boat *Tugaloo* up the river for the purpose of removing some of the worst snags and blasting out a small rock shoal above Dublin, Ga. Owing to the unusually low stage of the water the boat was unable to reach the locality to be worked and was ordered back to work on the Savannah River. At Savannah the boat was hauled out on marine railway for the purpose of repairing a bad hole in her bottom, sustained while attempting to proceed up the Oconee River.

Of the total amount expended during the fiscal year $1,198.94 was for making repairs to the snag boat *Tugaloo*, above mentioned; $293.63 for payment of outstanding liabilities on account of snagging done in June, 1904; and $1,995.66 for maintenance and repairs to snag boat *Oconee* and for contingencies.

The proportion of the approved project accomplished up to June 30, 1905, is about 40 per cent.

It is proposed to apply available balances and additional appropriation recommended to the removal of snags and other obstructions from the river between the Forks and a point 25 miles above Dublin, and, if possible, to extend the work to Milledgeville. Also to remove rock ledges just above Dublin.

Rock ledges above Dublin and long sand shoals below Milledgeville require removal and the channel needs improvement at several places between Dublin and the Forks.

COMMERCE AND NAVIGATION.

The Oconee River is navigable from the mouth to Milledgeville. During the year 1904 the steamers plying the river in the vicinity of Dublin handled 32,160 tons of freight, valued at $443,225. In addition to this there were rafted down the river during the same year 60,237,440 feet B. M. of timber, valued at about $737,000. Excepting the timber traffic, the commerce of the river is carried on in detached segments tributary to the railroads crossing the river.

Money statement.

July 1, 1904, balance unexpended	$4,303.49
Amount appropriated by river and harbor act approved March 3, 1905	15,000.00
Amount received from proceeds of sale of Government property	15.00
	19,318.49
June 30, 1905, amouunt expended during fiscal year, for works of improvement	4,318.49
July 1, 1905, balance unexpended	15,000.00
July 1, 1905, outstanding liabilities	338.14
July 1, 1905, balance available	14,661.86
Amount (estimated) required for completion of existing project	111,842.00

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Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$30,000.00	
For maintenance of improvement	10,000.00	
		$40,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

AMOUNT AND DATE OF ALL APPROPRIATIONS.

Since the works of improvement were begun the following appropriations have been made:

By act of Congress of—	
June 18, 1878	$10,000.00
March 3, 1879	1,500.00
June 14, 1880	1,500.00
March 3, 1881	2,500.00
August 2, 1882	5,000.00
July 5, 1884	3,000.00
August 5, 1886	9,000.00
August 11, 1888	12,500.00
Total	45,000.00
Unexpended balance from last appropriation carried to new project	177.82
Total	44,822.18

Since the existing project for improving the Oconee River was adopted the following appropriations have been made for this work:

By act of Congress of—	
August 11, 1888 (unexpended balance)	$177.82
September 19, 1890	25,000.00
July 13, 1892	25,000.00
August 18, 1894	10,000.00
June 3, 1896	10,000.00
March 3, 1899	10,000.00
June 6, 1900 (allotted from emergency appropriation)	3,750.00
June 13, 1902	25,000.00
March 3, 1905	15,000.00
Total	123,927.82
Amount received from proceeds of Government property	43.00
Amount received from proceeds of Government property	15.00
Grand total	168,808.00

O 7.

IMPROVEMENT OF OCMULGEE RIVER, GEORGIA.

This river is tributary to the Altamaha River.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1905.

Six hundred and sixty-nine snags, 7 logs, and 42 stumps were removed from the channel and 24 overhanging trees cut on the banks of the stream. A portion of an old jetty at Dents Landing, which obstructed navigation at that point, was also removed.

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Of the total amount expended during the fiscal year, $480.04 was for snagging and $1,916.36 for repairs to snag boat *Oconee*, maintenance of other plant, and for contingencies.

It is proposed to apply available balances and additional appropriation recommended toward the removal of snags, rock and sand shoals, revetting caving banks, and the cutting of overhanging trees, principally between Hawkinsville and Macon.

The proportion of the approved project accomplished up to June 30, 1905, is about 80 per cent.

The difficulty of maintaining the depth at the upper end of the river at Macon is in preventing erosion of the banks, and to overcome this much more revetting of the banks will have to be done than was estimated for in the existing project.

Owing to freshets, unforeseen changes in the channel, and damages to the dikes and dams and regulating constructions, it will be necessary to provide further funds to complete the improvement as originally planned, which improvement should be continued until the benefits desired are realized. To accomplish this the sum of $75,000 should be appropriated for prosecution of the work, and the further sum of $5,000 annually for maintenance.

COMMERCE AND NAVIGATION.

A detailed discussion of this subject will be found on pages 1478 to 1484 of the Report of the Chief of Engineers for 1890, and page 1520 of the same report for 1897.

At present there is no navigation at all between Macon and Hawkinsville, except that one small steamer occasionally goes to Macon.

During the calendar year 1904 the steamers plying the river handled 7,497 tons of freight, valued at about $248,430.

There were also rafted down the river 23,513,969 feet B. M. of timber, valued at about $261,123.

Money statement.

July 1, 1904, balance unexpended		$3,985.00
Amount appropriated by river and harbor act approved March 3, 1905		15,000.00
		18,985.00
June 30, 1905, amount expended during fiscal year, for works of improvement		2,396.40
July 1, 1905, balance unexpended		16,588.60
July 1, 1905, outstanding liabilities		802.90
July 1, 1905, balance available		15,785.70
Amount (estimated) required for completion of existing project		70,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$30,000.00	
For maintenance of improvement	10,000.00	
		40,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

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AMOUNT AND DATE OF ALL APPROPRIATIONS.

Upon the original project of improvement of the Ocmulgee River, adopted in 1876, the following appropriations were made:

By act of Congress of—	
August 14, 1876	$15,000.00
June 18, 1878	15,000.00
March 3, 1879	7,000.00
June 14, 1880	7,000.00
March 3, 1881	5,000.00
August 2, 1882	5,000.00
July 5, 1884	3,000.00
August 5, 1886	7,500.00
August 11, 1888	15,000.00
Total	79,500.00
Unexpended balance carried forward from last appropriation to new project	109.27
Total	79,390.73

Since the existing project for improving Ocmulgee River was adopted the following appropriations have been made for the work:

By act of Congress of—	
August 11, 1888 (unexpended balance)	$109.27
September 19, 1890	30,000.00
July 13, 1892	25,000.00
August 18, 1894	10,000.00
June 3, 1896	10,000.00
March 3, 1899	20,000.00
June 6, 1900	40,000.00
March 3, 1901	40,000.00
June 28, 1902	56,000.00
March 3, 1905	15,000.00
Total	246,109.27
Total, all appropriations	325,500.00
Amount received from proceeds of Government property November 12, 1902	106.00
Amount received from proceeds of Government property October 28, 1903	43.00
Amount reclaimed by Captain Gillette	20.00
Grand total	325,669.00

O 8.

IMPROVEMENT OF BRUNSWICK HARBOR, GEORGIA.

Appropriations for this improvement under the Engineer Department have heretofore been made for the removal of a shoal in East River opposite the lower part of the city. The act of Congress approved June 13, 1902, provided also for the improvement of the bar, which work had theretofore been carried on by direct contract between Congress and a private individual. It also provided for dredging in Academy Creek to an amount not to exceed $5,000.

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OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1905.

Inner harbor.—Dredging operations were continued by Morris & Cumings Dredging Company, of New York, N. Y., under contract of November 19, 1902, until September 9, 1904, when the work was completed. During the fiscal year these contractors removed 126,901.3 cubic yards of material. The total quantities of material removed under this contract were 485,142.9 cubic yards from the inner harbor and 23,783 cubic yards from Academy Creek.

A self-registering tide gauge was installed and was in operation throughout the fiscal year.

An examination was made in May, 1905, of the channel opposite the lower part of the city.

Academy Creek: No work was done during the fiscal year.

Outer bar.—The U. S. dredge *Cumberland* resumed operations on the outer bar on January 9, 1905, and between that date and June 30, 1905, removed 393,482 cubic yards of material, which, added to 141,472 cubic yards removed during the previous fiscal year, makes a total of 534,954 cubic yards removed from the outer bar by this dredge. The cost of dredging with the *Cumberland* during the fiscal year was 6.78 cents per cubic yard. A record of the working of this dredge from January 9 to June 30, 1905, is as follows:

(From January 1 to 7, inclusive, the dredge was undergoing repairs, etc., at Savannah, and January 8 en route to Brunswick.)

	January.	February.	March.	April.	May.	June.
At work	Days. 14½	Days. 12	Days. 16	Days. 20	Days. 22½	Days. 20½
Time lost:						
Sundays	3	4	4	5	4	4
Holidays	0	1	0	0	1	0
Cleaning boilers	0	2	1	1	1	1
Rough weather and fog	4½	9	9	2	2½	3½
Undergoing repairs	1	0	0	2	0	1
Other causes	0	0	1	0	0	0
Total time lost	8½	16	15	10	8½	9½

	January.	February.	March.	April.	May.	June.
Total time consumed in loading...hrs. and mins..	44 35	40 29	65 02	79 00	93 30	103 27
Total time consumed in dumping.....do....	79 44	71 47	77 04	100 36	137 48	107 52
Total distance to and from dump ground..miles..	675	565	598	736	1,000	636
Total number of loads made	60	57	67	84	101	96

Cost of operating.	January.	February.	March.	April.	May.	June.
Labor	$1,571.15	$1,525.99	$1,574.99	$1,570.83	$1,576.66	$1,584.98
Subsistence	623.85	487.84	506.87	655.55	296.63	439.62
Coal	1,600.71	1,437.33	1,670.54	1,698.64	2,174.06	1,663.00
Oils	23.66	24.25	63.09	45.55	47.53	96.70
Minor repairs	184.46	378.53	176.65	0.00	133.13	272.86
Miscellaneous	273.09	214.03	460.20	174.50	932.94	515.88
Total	4,276.92	4,067.97	4,452.34	4,144.57	5,160.97	4,573.04

	January.	February.	March.	April.	May.	June.
Amount of material removed (cubic yards)	48,236	47,284	57,886	76,043	88,364	75,669
Cost (cents) per cubic yard	8.87	8.60	7.69	5.45	5.84	6.04

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A preliminary examination of Brunswick Inner Harbor and outer bar, provided for by act of Congress approved March 3, 1905, was made and report thereon submitted June 3, 1905. A survey of the inner harbor has been ordered. A survey of the outer bar, called for by the act of March 3, 1905, is about two-thirds completed.

Of the total amount expended during the fiscal year, $40,110.82 was for dredging in the inner harbor, under contract with Morris & Cumings Dredging Company, at 20 cents per cubic yard, and $3,586.96 for surveys and contingencies; for the outer bar, $24,077.95 was for operating the U. S. dredge *Cumberland*, the cost per cubic yard for dredging being 6.78 cents, and $3,546.12 for surveys and contingencies.

On June 30, 1905, the approved project for Brunswick Inner Harbor was completed. The project for the outer bar was practically completed on that date, there remaining only about ten days' work to be done with the dredge *Cumberland*. There is no approved project for the improvement of Academy Creek. A small amount of dredging has been done under special allotment.

It is proposed to expend the available balances and additional appropriation recommended in maintaining the improvement of Brunswick Inner Harbor and outer bar by dredging and raising of the training wall, and providing a channel of the requisite width and depth in Academy Creek.

COMMERCE AND NAVIGATION.

Information in regard to the commerce of Brunswick before the improvement will be found on page 1523 of the Report of the Chief of Engineers for 1897.

The chief articles of export are cotton, lumber, cross-ties, and naval stores, of which the shipments for the year 1904 were as follows: Of cotton, 150,639 bales; of lumber and cross-ties, 285,614,859 feet; and of naval stores, 59,466 barrels of turpentine and 198,419 barrels of rosin.

The regular lines of steamships established between this port and New York and Boston comprise a total of 13 steamers. During the year 1904 they made 85 round trips and carried 166,275 tons of freight.

On the inland waters there are a number of small steamers plying between Brunswick and adjacent ports, besides numerous schooners and small sailboats. It is estimated that for the year 1904 this portion of the commerce amounted to 25,380 tons, valued at about $312,860.

The total tonnage of the port, inward and outward bound, coastwise and foreign, during 1904 was 1,417,157 tons, valued at $29,939,416.

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Money statement.

July 1, 1904, balance unexpended	$70,430.98
Amount appropriated by river and harbor act approved March 3, 1905	40,000.00
	110,430.98
June 30, 1905, amount expended during fiscal year, for works of improvement	71,321.85
July 1, 1905, balance unexpended	39,109.13
July 1, 1905, outstanding liabilities	5,506.09
July 1, 1905, balance available	33,603.04
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	25,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

AMOUNT AND DATE OF ALL APPROPRIATIONS.

Since the work of improvement was begun the following appropriations have been made:

By act of Congress of—		
July 4, 1836		$10,000
March 3, 1879		20,000
June 14, 1880		10,000
March 3, 1881		5,000
August 2, 1882		25,000
July 5, 1884		10,000
August 5, 1886		22,500
August 11, 1888		35,000
September 19, 1890		35,000
July 13, 1892		27,500
Total		200,000
For maintenance:		
August 18, 1894		10,000
June 3, 1896		15,000
March 3, 1899		10,000
Aggregate		235,000
By act of Congress of June 13, 1902:		
Outer bar	$40,000	
Inner harbor	120,000	
Academy Creek	5,000	
		165,000
By act of Congress of March 3, 1905		40,000
Total of all appropriations		440,000

CONTRACT IN FORCE.

Name and address of contractor: Morris & Cumings Dredging Company, New York, N. Y.
Character and amount of work: 560,000 cubic yards; dredging.
Rate per cubic yard: 20 cents.
Date of approval: December 11, 1902.
Work begun: February 19, 1903.
Expires: March 19, 1904.[a]

[a] Time of completion extended; no specific date fixed. Completed September 9, 1904.

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COMMERCIAL STATISTICS.

Arrivals and clearances of vessels and commerce at Brunswick, Ga., 1904.

	Coastwise.			Foreign ports.						Total.		
				American vessels.			Foreign vessels.					
	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.
Arrived	513	617,199	10,956	16	10,678	141	76	56,805	1,078	605	684,682	12,175
Cleared	506	591,098	10,685	8	3,657	62	103	94,230	1,616	617	688,985	12,363

Commerce (coastwise and foreign), 1904.

Value of exports	$16,727,562.00
Value of imports	12,087,994.00
Total collections	5,400.99

Statement of receipts of naval stores, 1904.

Rosin	barrels	208,892
Spirits	do	57,380

O 9.

IMPROVEMENT OF INSIDE WATER ROUTE BETWEEN SAVANNAH, GEORGIA, AND FERNANDINA, FLORIDA.

The description of this route will be found in the Report of the Chief of Engineers for 1900, page 1953, and the waters forming it are also shown on Coast Survey charts Nos. 156 and 157.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1905.

Dredging operations were resumed at "The Dividings" on January 9, 1905, by George T. Warner, under his contract of March 28, 1903, and completed February 20, 1905, 11,830.7 cubic yards being removed. The total quantity of material removed under this contract was 68,459.7 cubic yards, the portions of the route improved being "The Dividings," Jekyl Creek, mouth of Jekyl Creek, and Mud River.

The outer end of the jetty at the mouth of Jekyl Creek was marked by a cluster of piling.

Examinations were made in May and June, 1905, of Jekyl Creek, Altamaha and Buttermilk sounds, Little Mud River, and a portion of Mud River, for the purpose of obtaining data upon which to base specifications for dredging.

The proportion of the approved project accomplished up to June 30, 1905, is 55 per cent.

Of the amount expended during the fiscal year, $1,851.64 was for dredging under contract, at 16¾ cents per cubic yard; $215, part of cost of new hull for U. S. S. *Angler*, and $301.26 for contingencies.

It is proposed to apply available balances and additional appropriation recommended toward providing the project depth at the various shoals between Savannah and Fernandina.

The $41,000 appropriated by act of Congress of March 3, 1905, completes the original estimate of $105,000 for this improvement. Owing to the fact that this original estimate was not all made available at

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one time, but has been appropriated in different amounts over a period of thirteen years with no provision being made for maintenance, it has been impossible to complete the project for the sum stated therein. With the small amounts which have been appropriated from time to time it has only been possible to dredge narrow channels, which have shoaled rapidly in consequence of having insufficient width. There are also several portions of the route now in need of dredging which, at the time the project was submitted, had ample channel depths and widths and were not considered in the estimate of cost. The present project should be modified so as to provide for the establishment of a navigable channel 10 feet deep at mean low water with a width ranging from 150 to 200 feet, over the entire route from Savannah to Fernandina, to be accomplished by dredging and the construction of training dikes wherever necessary. The military necessities for this safe route for passage of torpedo boats and such craft, combined with the growing importance of the commercial advantages which it possesses, leaves no room for doubt in my mind as to the advisability of its further improvement.

For the restoration of dredged channels and removal of shoals formed since commencement of improvement, so as to complete the project as originally planned, the additional sum of $50,000 is required, plus an annual appropriation of $10,000 for maintenance.

An estimate, sufficiently accurate, of the cost of providing a channel 10 feet deep at mean low water over the entire route, with branches reaching to Brunswick and Darien, can be submitted readily if called for.

COMMERCE AND NAVIGATION.

A detailed discussion of the commerce over this route will be found in the Report of the Chief of Engineers for 1901, page 1653.

The commerce over this route is carried on, to a large extent, by small schooners, and it is almost impossible to obtain authentic information as to its amount and value. On the lower end of the route there are several small steamboats, making regular trips between Brunswick, Darien, Fernandina, and St. Simons, and Cumberland Island and the Satilla River. During the calendar year 1904 these steamboats and such schooners as it has been possible to obtain information from carried over the route 59,983 tons of freight, valued at about $1,183,754.

In addition to this it is estimated there were rafted over this route during the same period about 73,300,000 feet B. M. of timber, valued at about $849,600.

None of this commerce went over the entire route.

Money statement.

July 1, 1904, balance unexpended	$2,648.30
Amount appropriated by river and harbor act approved March 3, 1905	41,000.00
	43,648.30
June 30, 1905, amount expended during fiscal year, for works of improvement	2,367.90
July 1, 1905, balance unexpended	41,280.40
July 1, 1905, outstanding liabilities	466.93
July 1, 1905, balance available	40,813.47

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Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	$10,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

AMOUNT AND DATE OF ALL APPROPRIATIONS.

Previous to the existing project there were appropriated as follows:

Parsons Cut or Romerly Marshes, Georgia:	
Act of Congress approved—	
August 2, 1882	$10,000.00
July 5, 1884	10,000.00
August 5, 1886	17,475.00
August 11, 1888	4,633.77
Total by United States	42,108.77
From Georgia and Florida Steamboat Company	5,000.00
Total	47,108.77
Jekyl Creek, Georgia:	
Act of Congress approved—	
August 11, 1888	5,000.00
September 19, 1890	7,500.00
July 13, 1892	7,500.00
August 18, 1894	4,000.00
Total	24,000.00

Since the existing project for improving this route was adopted five appropriations, aggregating $105,000, have been made, as follows:

Inside route:	
Act of Congress approved—	
July 13, 1892	$15,000.00
August 18, 1894	20,000.00
June 3, 1896	14,000.00
June 13, 1902	15,000.00
March 3, 1905	41,000.00
	105,000.00
Making a total of	176,108.77

CONTRACT IN FORCE.

Contractor: George T. Warner, Savannah, Ga.
Character of work: Dredging 93,000 cubic yards.
Rate: 16¾ cents per cubic yard.
Date of approval: April 16, 1903.
Work begun: December 7, 1903.
Expires: May 16, 1904.[a]

O 10.

IMPROVEMENT OF SKIDAWAY NARROWS, GEORGIA.

Skidaway Narrows is a narrow, tortuous, and shallow water course, and, when improved, will constitute an alternative or additional route for a portion of the approved inside route between

[a] Extended, no specific date fixed; completed February 20, 1905.

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Savannah, Ga., and Fernandina, Fla. The project for its improvement will be found printed as House Executive Document No. 450, Fifty-eighth Congress, second session. This project provided for the dredging of a channel to the west of the narrows. Subsequent developments, however, made it necessary to abandon this route and adopt one following practically the course of the narrows, which new route was approved by the Chief of Engineers under date of June 2, 1905 (36738–16). The improvement proposed contemplates the dredging of a channel 6 feet deep at mean low water and 75 feet wide, to connect Burnside River with Isle of Hope or Skidaway River. The estimated cost is $55,000.

No work was done during the fiscal year, the amount expended being for the purchase of a cash and allotment book.

It is proposed to expend the balance on hand and additional appropriation recommended in dredging the approved channel.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1905	$20,000.00
June 30, 1905, amount expended during fiscal year, for works of improvement	5.50
July 1, 1905, balance unexpended	19,994.50
Amount (estimated) required for completion of existing project	35,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	35,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

O 11.

IMPROVEMENT OF CUMBERLAND SOUND, GEORGIA AND FLORIDA.

The entrance to Cumberland Sound is situated between Cumberland Island, Georgia, and Amelia Island, Florida. The principal port is Fernandina, in the State of Florida.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1905.

The U. S. dredge *Cumberland* removed 59,412 cubic yards of material from the north jetty channel between October 22 and November 9, 1904, at a cost of 7.7 cents per cubic yard.

Work on the dike for the closing of a breach in the beach on Cumberland Island was carried on continuously from July 1 to September 7, 1904. During this period there were placed in the dike 10,616 cubic yards of brush fascines, 1,823 cubic yards of stone, and 3,000 feet B. M. of lumber. A storm occurring in October, 1904, caused undermining and necessitated the placing of 817 cubic yards of brush fascines, 185 cubic yards of stone, and 50 sand bags in low places in the dike. Further settlement, due to undermining, occurred between November, 1904, and February, 1905, and in order to stop

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this recurring damage it became necessary to stop all flow of water through the dike by placing sheet piling along about 1,200 feet of the dike on both sides. For this purpose 60,000 feet B. M. of lumber were used, and an additional 1,853 cubic yards of brush fascines and 673 cubic yards of stone were placed in the dike. There were also used 80 cubic yards of oyster shells on the sea side of the dike to assist in stopping the flow through the same. The total quantities of material placed in the dike during the fiscal year were 13,286 cubic yards of brush fascines, 2,681 cubic yards of stone, 63,000 feet B. M. of lumber, 50 sand bags, and 80 cubic yards of oyster shells. The above work was done by hired labor, and at the close of the fiscal year there remained about fifteen days' work to complete.

The dike has been successful in entirely stopping the flow through the old breach, and is causing the beach to sand up rapidly. When heavy northeast winds occur the flood tide reaches the dike on the sea side much sooner than it does on the Beach Creek side on account of the alignment of the north jetty and also by reason of the flood propagation having to go around the point of Cumberland Island and up the creek. There is often a difference in the level of the water's surface inside and outside of the dike of 3 feet. This pressure against the dike causes undermining, the foundation consisting at the main break of nothing but soft marsh mud. For the present the danger of a bad break at this point has been apparently averted, but the dike will have to be carefully watched and repaired from time to time as the necessity arises.

An incipient break at the inner end of the north jetty was remedied by the placing of 10 cubic yards of brush fascines and 25 cubic yards of stone.

A complete survey of the entrance was made in April, 1905.

A preliminary examination of Fernandina Harbor, provided for by act of Congress of March 3, 1905, was made and report thereon submitted May 26, 1905. A survey has been ordered.

A contract was entered into on June 14, 1905, with Roderick G. Ross, of Jacksonville, Fla., for raising and repairing the two stone jetties, consisting principally of closing a gap at the inner end of the south jetty and raising this jetty at two places between stations 2100 and 8900, and raising the extreme end of both jetties. This contract was approved by the Chief of Engineers on June 28, 1905. Work thereunder will begin about August 1, 1905.

So far as the required depth is concerned the project is completed, and further appropriations should be for the maintenance of existing works of improvement.

Of the total amount expended during the fiscal year, $1,260 was for use of U. S. dredge *Cape Fear* and $2,240 for use of U. S. dredge *Winyah Bay*, during the fiscal year 1903; $15,422.86 for dike work; $4,570.16 for operating the dredge *Cumberland*, the cost per cubic yard for dredging being 7.7 cents, and $8,432.93 for repairs to dredge, and for cost of surveys and other contingencies of the work, $5,817.56.

It is proposed to expend available balances and additional appropriation recommended in raising the south jetty at its outer end and in raising low places in the completed work; to maintain the dike on Cumberland Island, and to do such dredging as may be necessary to maintain a navigable channel.

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COMMERCE AND NAVIGATION.

Neglecting the commerce of St. Marys, Ga., the total commerce of the harbor of Fernandina during the calendar year 1904 amounted to 754,982 tons, with a value of $10,715,805. The details of this commerce are given in the tables appended hereto.

Money statement.

July 1, 1904, balance unexpended		$106,171.47
Amount deposited by Major Sanford		265.45
		3,676.35
Amount appropriated by river and harbor act approved March 3, 1905	30,000.00	
Amount appropriated by sundry civil act approved March 3, 1905	40,000.00	
		180,113.27
June 30, 1905, amount expended during fiscal year, for maintenance of improvement		37,743.54
July 1, 1905, balance unexpended		142,369.73
July 1, 1905, outstanding liabilities		4,394.92
July 1, 1905, balance available		137,974.81
July 1, 1905, amount covered by uncompleted contracts		65,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		100,000.00

AMOUNT AND DATE OF ALL APPROPRIATIONS.

Under the original project for improving Cumberland Sound the following appropriations were made for the work:

By act of Congress of—	
June 14, 1880	$30,000
March 3, 1881	100,000
August 2, 1882	50,000
July 5, 1884	75,000
August 5, 1886	112,500
August 11, 1888	112,500
Total	480,000

Under the revised project of improvement the following appropriations were made:

By act of Congress of—	
September 19, 1890	$112,500
July 13, 1892	170,000
August 17, 1894	170,000
Total	452,500

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Under the existing project of improvement the following appropriations have been made:

By act of Congress of—	
June 3, 1896	$5,000.00
June 4, 1897	350,000.00
July 19, 1897	50,000.00
July 1, 1898	450,000.00
March 3, 1899	400,000.00
March 3, 1901	200,000.00
June 28, 1902	400,000.00
March 3, 1903	400,000.00
April 28, 1904	55,000.00
March 3, 1905, river and harbor act	30,000.00
March 3, 1905, sundry civil act	40,000.00
Total	2,380,000.00
Deposited by Maj. J. C. Sanford, Corps of Engineers	265.45
Deposited by Maj. J. C. Sanford, Corps of Engineers (rental of dredge *Cumberland*)	3,676.35
Total	2,383,941.80
Grand total	3,316,441.80

CONTRACT IN FORCE.

Contractor: Roderick G. Ross, Jacksonville, Fla.
Character of work: Repairs to jetties, 23,465 cubic yards of stone.
Rate: $2.77 per cubic yard.
Date of approval: June 28, 1905.
Work not yet begun: Must commence by August 30, 1905.
Expires: Six months after date of commencement.

COMMERCIAL STATISTICS.

Arrivals and clearances of vessels and commerce at Fernandina, Fla., 1904.

	Coastwise.			Foreign ports.						Total.		
				American vessels.			Foreign vessels.					
	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.
Arrived	294	248,653	3,334	24	15,131	204	73	92,359	1,399	391	356,143	4,937
Cleared	295	198,161	2,526	11	4,993	92	128	178,456	2,615	434	376,610	5,233

COMMERCE.

Value of exports:	
Foreign	$7,698,408.00
Coastwise	1,695,423.00
Value of imports:	
Foreign	119,529.00
Coastwise	73,065.00
Total commerce	9,586,425.00
Duties collected	2,144.12

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O 12.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

The work of removing the wrecks of the *City of Austin*, *Franconia*, and *Puntalunos* in Cumberland Sound, under emergency contract of August 8, 1903, with William H. Virden, of Tampa, Fla., was continued until August 12, 1904, when the removal of the wrecks was completed. During the fiscal year work of removal was confined to the wreck *Puntalunos*, the other two wrecks having been removed during the previous fiscal year.

The total amount expended during the fiscal year was $8,290.15, of which $5,786.85 was paid the contractor, $147.15 for contingencies, and $2,356.15, the remaining balance of the allotment, was returned to the Treasurer of the United States.

CONTRACT IN FORCE.

Contractor: William H. Virden, Tampa, Fla.
Character of work: Removal of three wrecks in Cumberland Sound.
Amount of contract: $5,990.
Date of approval: Emergency contract; no approval.
Work begun: September 7, 1903.
Expires: December 8, 1903.[a]

[a] Extended. No specific date fixed. Completed August 12, 1904.

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APPENDIX P.

IMPROVEMENT OF CERTAIN RIVERS AND HARBORS IN FLORIDA.

REPORT OF MAJ. FRANCIS R. SHUNK, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1905, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. St. Johns River, Florida.
2. St. Johns River at Orange Mills Flats, Florida.
3. Volusia bar, Florida.
4. Oklawaha River, Florida.
5. Indian River, Florida.
6. Biscayne Bay, Florida.
7. Harbor at Key West, Florida and entrance thereto.
8. Kissimmee River, Florida.
9. Orange River, Charlotte Harbor, and Caloosahatchee River, Florida.
10. Sarasota Bay, Florida.
11. Tampa Bay, Florida.
12. Hillsboro Bay, Florida.
13. Crystal, Anclote, Suwanee, and Withlacoochee rivers, Florida.
14. Manatee River, Florida.
15. Removing the water hyacinth from Florida waters.
16. Dredge for river and harbor improvements, Florida.
17. Removing sunken vessels or craft obstructing or endangering navigation.

UNITED STATES ENGINEER OFFICE,
Jacksonville, Fla., July 19, 1905.

GENERAL: I have the honor to submit herewith annual report upon the works of river and harbor improvement in this district, for the fiscal year ending June 30, 1905.

Very respectfully, your obedient servant,

FRANCIS R. SHUNK,
Major, Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

P 1.

IMPROVEMENT OF ST. JOHNS RIVER, FLORIDA.

For description, original project, results, etc., see summary, page 288, and reports of Chief of Engineers for 1895, pages 1586–1604 (this being a report upon the survey of the St. Johns River, Florida,

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from Jacksonville to the ocean, with a view to securing a 24-foot channel); for 1896, pages 1305–1312; for 1898, pages 1327–1330, and for 1904, pages 1685–1690.

No work was done on the jetties at the entrance during the past fiscal year.

The construction of the training walls in the river was completed December 15, 1904. During the fiscal year 153.3 square yards of fascine mattress, 33,247.9 cubic yards of stone, and 28,612.1 cubic yards of shell were placed in these works.

Bids for dredging in the river were opened June 10, 1904. Separate prices were given for the portions of the river above and below New Berlin, the United States reserving the right to accept proposals for either section; work in the other section to be done by hired labor. The lowest bid received was that of the North American Dredging Company, San Francisco, Cal. The acceptance of this bid for the lower section of the river was authorized by the Chief of Engineers August 9, 1904. Contract was entered into August 24 and approved by the Chief of Engineers September 16. The quantity to be removed under this contract will be about 2,435,000 cubic yards of soft material. Dredging under this contract began January 2, 1905.

At the end of June, 1905, a total of 1,133,655.8 cubic yards had been removed under this contract, completing New Berlin and St. Charles Creek cuts, sections B and C, and a length of 4,600 feet of the upper portion of section A of Browns Creek cut to the full width of 300 feet, and the southerly half of sections A and B and the northerly half of section C of Mile Point cut to a width of 150 feet.

Dredging was done to a depth of 25 feet at mean low water.

With a few slight exceptions, the depth attained has been maintained throughout. The contract price for this work is 8.23 cents per cubic yard.

The river dredge *Jacksonville*, which had been constructed by the United States, using machinery from the condemned Mississippi River Commission dredge *Alpha*, in 1903–4, continued at work during the year. During August, September, and October, 1904, new boilers and a new suction head were installed. The new machinery proved very satisfactory; but the engine could not be made to develop sufficient power to run the pump at the rate of speed necessary to handle the material which the new suction head can supply under usual conditions. Under date of May 16, 1905, the Chief of Engineers authorized the purchase of a new engine of ample power, two additional boilers, and a jet pump of 150 horsepower. This new machinery was under construction at the end of the fiscal year and will be installed during the next few months.

Delays were twice occasioned by collisions with passing steamships, and much of the material encountered was very tenacious clay.

During the year 350,000 cubic yards of material were removed by this dredge; completing a cut around Dames Point and through New Berlin, a cut 120 feet wide, and cuts aggregating 1,735 feet in length and of the same width through Brills Cut. Dredging was done to a depth of 24 to 26 feet at mean low water.

The seagoing suction dredge *St. Johns* (the construction of which was authorized by act of June 13, 1902) was completed, and arrived at Jacksonville March 31, 1905, and began dredging in Mile Point Cut April 11, 1905. A series of accidents occurred to the dumping

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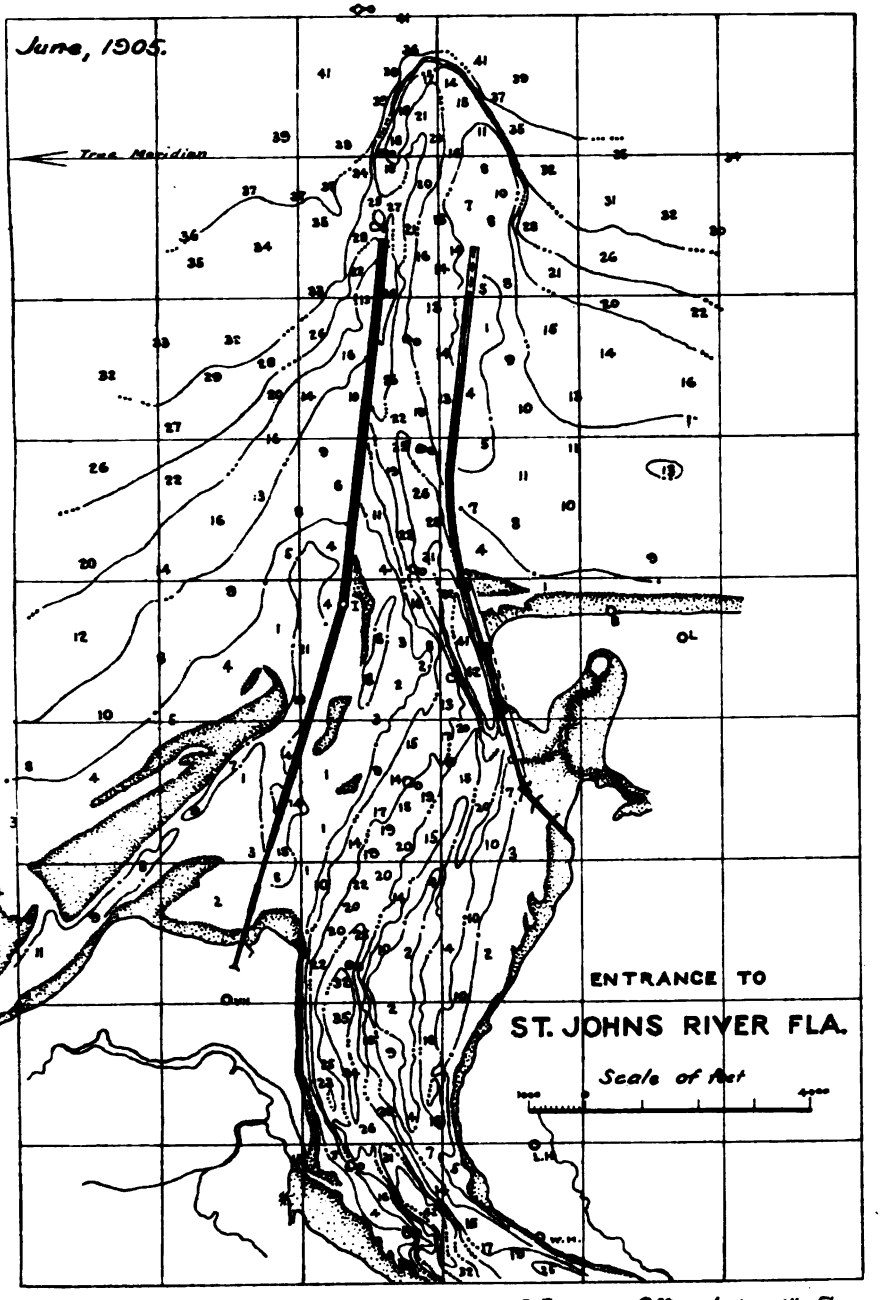

Note: Crest of Jetties
below Mean Low Water
at " " "
between M.L.W and M.H.W.
at or above Mean High Water

U.S. Engineer Office Jacksonville, Fla.
June 30, 1905.
To accompany annual report.

Francis Rehmke
Major, Corps of Engineers, U.S.A.

Eng 59 1

THE NORRIS PETERS CO. PHOTO-LITHO. WASHINGTON D. C.

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gates, and after dredging only 3,203 cubic yards the dredge proceeded to League Island Navy-Yard, Philadelphia, Pa., for repairs and to have the hull copper sheathed. The dredge arrived at Philadelphia April 26 and returned to Jacksonville May 31. Work was resumed in Wards Bank Cut June 3. At the end of June 52,905 cubic yards had been removed from that locality, which, together with the amount removed from Mile Point Cut, makes a total of 56,108 cubic yards removed by this dredge. The work done during June cost 5.94 cents per cubic yard.

The map of the survey of the entrance to the river made in June, 1905, on a scale of 1:30,000, is submitted herewith. The sailing line across the outer shoal forming the bar remains in the same location reported last year, crossing the line in prolongation of the north jetty.

The area between the jetties is generally deeper than last year. The outer slope of the bar has advanced seaward about 500 feet, and the available mean low water depth over the bar is 25 feet. Shoaling continues seaward of the outer end of the south jetty and along the southern side of this jetty.

The crest of the north jetty is at about the level of mean high water and slightly above that plane in places throughout its length.

The crest of the south jetty is at about the plane of mean high water from shore out to station 8,000, about 1 foot above mean low water between stations 8,000 and 10,000, and gradually slopes to 10 feet below mean low water from station 10,000, to the outer end, at station 10,712.

It is proposed to apply the available balance to continuing the improvement by dredging. The work in the portion of the river between Browns Creek and Mayport will be done by contract. The portions of the work above New Berlin and in front of and below Mayport will be done by hired labor, using the U. S. dredges *Jacksonville* and *St. Johns*.

The additional appropriation recommended is to be applied to continuing the work of dredging the shoal places in the river and to building up the jetties at the entrance.

The project was about 70 per cent completed at the end of the fiscal year.

Money statement.

July 1, 1904, balance unexpended		$384,583.30
Amount appropriated by river and harbor act March 3, 1905		100,000.00
Amount appropriated by sundry civil act approved March 3, 1905		205,000.00
Amount deposited, sale of old material	$445.96	
Amount deposited, unexpended balance River and Harbor Board	89.16	
		535.12
		690,118.42
June 30, 1905, amount expended during fiscal year, for works of improvement		[a] 399,859.87
July 1, 1905, balance unexpended		290,258.55
July 1, 1905, outstanding liabilities		[b] 35,152.21
July 1, 1905, balance available		255,106.34

[a] Includes $48,182.69 on account of construction of dredge *St. Johns*.
[b] Includes $2,665.99 on account of construction of dredge *St. Johns*.

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July 1, 1905, amount covered by uncompleted contracts	[a] $112,213.12
Amount (estimated) required for completion of existing project	309,750.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:	
For works of improvement	$309,750.00
For maintenance of improvement	50,000.00
	359,750.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

APPROPRIATIONS FOR IMPROVEMENT OF ST. JOHNS RIVER, FLORIDA.

Under the original project the following appropriations were made for the work:

June 14, 1880	$125,000	September 19, 1890	$170,000
March 3, 1881	100,000	July 13, 1892	112,500
August 2, 1882	150,000	March 3, 1893	284,500
July 5, 1884	150,000		
August 5, 1886	150,000	Total	1,417,000
August 11, 1888	175,000		

Under the existing project of improvement appropriations have been made—

June 3, 1896	$200,000.00	June 6, 1900 (allotment and emergency appropriation)	$10,000.00
March 3, 1899	200,000.00	Sale of old material	445.96
June 13, 1902	[b] 350,000.00	Unexpended balance allotment for River and Harbor Board	89.16
March 3, 1903	350,000.00		
April 28, 1904	395,000.00	Aggregate	3,227,535.12
March 3, 1905, sundry civil act	205,000.00		
March 3, 1905	[c] 100,000.00		
Total	1,800,000.00		

CONTRACTS IN FORCE.

Contractor: Roderick G. Ross.
Work: Training-wall construction.
Date: June 30, 1903.
Approved: January 15, 1904.
Date of beginning: October 6, 1903.
Date of completion: As provided in specifications.
Quantities: 66,000 cubic yards third-class stone, at $1.83 per cubic yard; 37,000 square yards fascine mattress, at 40 cents per square yard; 18,000 cubic yards oyster shells, at $1 per cubic yard; old material placed in new work, 24,180 cubic yards, at 40 cents per cubic yard; old material placed elsewhere, 2,700 cubic yards, at 30 cents per cubic yard.

Contractors: North American Dredging Company.
Work: Dredging.
Date: August 24, 1904.
Approved: September 16, 1904.
Date of beginning: December 19, 1904.
Date of completion: As provided in specifications.
Quantities: About 2,435,000 cubic yards sand, etc., at 8.23 cents.

[a] Includes $4,500 on account of construction of dredge *St. Johns*.
[b] And continuing contract for $950,000.
[c] And continuing contract for $309,750.

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COMMERCIAL STATISTICS.

Commerce of St. Johns River, Florida, during the year ending December 31, 1904.

[Furnished by Jacksonville Board of Trade.]

Articles.	Gross tonnage.	Articles.	Gross tonnage.
Bacon	4,415	Oats and corn	1,759
Canned goods	5,000	Oil and gasoline	15,483
Cement	6,092	Salt	2,251
Cotton	3,819	Shingles	83,217
Coal	84,738	Shoes	2,489
Cross-ties	51,570	Sugar	5,305
Cypress lumber	42,860	Tobacco	188
Fertilizer	27,091	Yellow-pine lumber	368,889
Fruits and vegetables	14,275	Wines and liquors	4,500
Flour	5,180	General merchandise	208,712
Kaolin	9,566		
Naval stores	57,927	Total	1,000,316

Arrivals and departures of vessels for the year ending December 31, 1904.

Kind of vessel.	Arrivals.		Departures.	
	Number.	Tons.	Number.	Tons.
Steamer	273	719,549	264	712,553
Sailing vessels	348		312	

Estimated percentage of total trade of neighborhood carried by water, 33⅓ per cent.

Probable increase of trade were the improvement completed: Fully 100 per cent.

Probable effect of the project on freight rates: Would reduce freight rates 12 to 15 per cent.

Transportation business established during 1904: Cook-Cummer Steamship Line.

Transportation business abandoned during 1904: None.

P 2.

IMPROVEMENT OF ST. JOHNS RIVER AT ORANGE MILLS FLATS, FLORIDA.

For description, project, and work done see Report of the Chief of Engineers for 1898, pages 1344–1348; for 1901, page 1738, and for 1904, pages 1690–1691.

The river and harbor act of March 3, 1905, appropriated $25,000 for continuing the improvement. Project for the expenditure of this amount was approved May 13, 1905.

It is proposed to apply the available funds in extending the channel through Tocoi shoal to a width of 120 feet, and in dredging a channel 120 feet wide and 13 feet deep through Forresters Point shoal by contract.

It is proposed to apply the additional appropriation recommended to completing the existing project by dredging.

The project was 60 per cent completed at the end of the fiscal year.

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Money statement.

Amount appropriated by river and harbor act approved March 3, 1905	$20,000.00
July 1, 1905, balance unexpended	20,000.00
Amount (estimated) required for completion of existing project	30,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	30,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

APPROPRIATIONS.

Act of—	
March 3, 1899	$40,000
June 13, 1902	30,000
March 3, 1905	20,000
Total	90,000

COMMERCIAL STATISTICS.

No commercial statistics for 1904 are available.

P 3.

IMPROVEMENT OF VOLUSIA BAR, FLORIDA.

For description, project, and results, see summary, page 291, and the report of the Chief of Engineers for 1897, page 1550, and for 1896, pages 1313–1314.

Work at Volusia bar had been deferred until the completion of the dredge and snag boat *Florida*. This boat was completed in March, 1905. The sum of $2,000 had been appropriated by the river and harbor act of June 13, 1902, $2,000 had been allotted from the emergency river and harbor act of April 28, 1904, and $2,000 was appropriated by the river and harbor act of March 3, 1905. A portion of the funds thus provided had been expended in the equipment of the dredge.

Work was begun at Volusia bar on April 4, 1905. Work was suspended, owing to exhaustion of funds, on May 17.

A total of 9,035.1 cubic yards of hard sand was removed from Volusia bar, forming a channel 1,100 feet long, 100 feet wide, and 7 feet deep at mean low water. One snag was removed from Lake George, 2 snags from Volusia bar, and 15 snags and 20 overhanging trees were removed from the river between Lakes George and Monroe; 7,225.9 cubic yards of sand were removed from Lake Monroe lower bar, forming a channel 1,050 feet long, 100 feet wide, and from 6 to 7 feet deep; 700 cubic yards of sand were removed from the point at Coxetters Bend, between Lakes George and Monroe.

It is proposed to apply the additional appropriation recommended to maintenance of this improvement. The project has been completed.

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Money statement.

July 1, 1904, balance unexpended	[a] $4,000.00
Amount appropriated by river and harbor act approved March 3, 1905	2,000.00
	6,000.00
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	[b] 6,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement in addition to the balance unexpended July 1, 1905	4,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

June 14, 1880	$5,000	August 18, 1894	$1,000
March 3, 1881	5,500	June 3, 1896	1,000
August 2, 1882	5,000	March 3, 1899	2,000
July 5, 1884	2,000	June 13, 1902	2,000
August 5, 1886	7,500	April 28, 1904	2,000
August 11, 1888	500	March 3, 1905	2,000
September 19, 1890	500		
July 13, 1892	1,000	Total	37,000

COMMERCIAL STATISTICS.

Commerce of Volusia bar during the year ending December 31, 1904.

[Furnished by Clyde Steamship Company.]

Article.	Gross tonnage.	Article.	Gross tonnage
Fertilizers	5,500	Railroad supplies	160
Fish and oysters	400	Sash, doors, and blinds	25
Fruits	600	Shingles	10
Grain	8,200	Sirup, honey, etc.	12
Hay	2,100	Tobacco	40
Hides	30	Turpentine and rosin	800
Live stock	170	Vegetables	8,350
Lumber	22,150		
Merchandise	14,300	Total	60,847
Oranges	2,500		

Arrivals and departures of vessels for the year ending December 31, 1904.

Kind of vessel.	Arrivals.		Departures.	
	Number.	Tons.	Number.	Tons.
Steamers	325	99,700	325	99,700

[a] Includes $2,000 from emergency river and harbor act of April 28, 1904.
[b] Includes $600 allotted for construction of dredge *Florida*.

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Estimated number of passengers carried by water	38,380
Estimated percentage of total trade of neighborhood carried by water, per cent	40
Probable increase of trade were the improvement completed—per cent	100
Probable effect of the project on freight rates	None.
Transportation business established during 1904	None.
Transportation business abandoned during 1904	None.

P 4.

IMPROVEMENT OF OKLAWAHA RIVER, FLORIDA.

For description, project, and results, attention is invited to the Report of the Chief of Engineers for 1896, pages 1314 to 1316, and to summary, page 292.

Work at Oklawaha River had been deferred until the completion of the dredge and snag boat *Florida*. This boat was completed in March, 1905.

The river and harbor act of June 13, 1902, appropriated $2,000, and the river and harbor act of March 3, 1905, appropriated $2,000 for continuing this improvement and for maintenance. A portion of the funds thus provided was expended for the equipment of the U. S. dredge *Florida*. This dredge began work on the river June 1, 1905. Work ceased June 28, owing to exhaustion of available funds; 204 snags and 117 overhanging trees were removed, and 710 cubic yards of material were dredged and placed on the bank with the clam-shell dredging appliances. The river was cleared of obstructions for a distance of 21 miles from the mouth.

It is proposed to apply the additional appropriation recommended to completing the existing project by removing obstructions and to maintenance of the improvement.

The project was 40 per cent completed at the close of the fiscal year.

Commercial statistics for 1904 are not available.

Money statement.

July 1, 1904, balance unexpended		$2,000.00
Amount appropriated by river and harbor act approved March 3, 1905		2,000.00
		4,000.00
June 30, 1905, amount expended during fiscal year, for maintenance of improvement		1,249.42
July 1, 1905, balance unexpended		2,750.58
July 1, 1905, outstanding liabilities		1,784.60
July 1, 1905, balance available		965.98
Amount (estimated) required for completion of existing project		16,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$16,000.00	
For maintenance of improvement	3,000.00	
		19,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

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APPROPRIATIONS.

September 19, 1890	$10,000	June 13, 1902	$2,000
July 13, 1892	1,000	March 3, 1905	2,000
August 18, 1894	3,000		
June 3, 1896	3,000	Total	24,000
March 3, 1899	3,000		

P 5.

IMPROVEMENT OF INDIAN RIVER, FLORIDA.

Between Goat Creek and Jupiter Inlet.—For history, description, and project see summary, page 293, and Report of Chief of Engineers for 1896, pages 1318–1320.

The river and harbor act of June 13, 1902, appropriated $2,000 for continuing the improvement, and the river and harbor act of March 3, 1905, appropriated $20,000 for continuing the improvement and for maintenance and provided for a survey of Sebastian Inlet. On May 5, 1905, the Chief of Engineers allotted $1,500 from this appropriation for this survey. The survey was begun May 19 and finished May 31. Report will be submitted at a later date.

Of the funds available, the sum of $805.76 was expended for the equipment of the U. S. dredge and snag boat *Florida* and $605.03 for survey of Sebastian Inlet.

It is proposed to expend the balance available to dredging opposite St. Lucie Inlet and elsewhere in this section of Indian River by hired labor, using the dredge *Florida*, and to apply the additional appropriation recommended to completing the existing project by dredging and to maintenance of the improvement.

No commercial statistics are available for 1904. The commerce is believed to be small.

The project was about 34 per cent completed at the close of the fiscal year.

Money statement.

July 1, 1904 balance unexpended		$2,014.62
Amount appropriated by river and harbor act approved March 3, 1905		20,000.00
		22,014.62
June 30, 1905, amount expended during fiscal year, for works of improvement		[a]1,410.79
July 1, 1905, balance unexpended		20,603.83
July 1, 1905, outstanding liabilities		665.38
July 1, 1905, balance available		19,938.45
Amount (estimated) required for completion of existing project		7,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$7,000.00	
For maintenance of improvement	2,000.00	
		9,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

[a] Includes $600 allotted for construction of dredge *Florida*.

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APPROPRIATIONS.

July 13, 1892 (between Goat Creek and Jupiter Inlet)	$15,000.00
August 18, 1894 (Negro Cut)	5,000.00
March 2, 1895 (Negro Cut)	15,000.00
February 26, 1896 (Jupiter Inlet)	500.00
June 3, 1896 (Negro Cut)	7,500.00
March 3, 1899 (Negro Cut)	5,000.00
June 13, 1902 (between Goat Creek and Jupiter Inlet)	2,000.00
March 3, 1905 (between Goat Creek and Jupiter Inlet)	20,000.00
Total	70,000.00
Allotment from emergency river and harbor appropriation of June 6, 1900 (for opening Jupiter Inlet)	1,000.00
Aggregate	71,000.00
For rent of dredge	14.62
Total	71,014.62

P 6.

IMPROVEMENT OF BISCAYNE BAY, FLORIDA.

For description of the project and work done by the Florida East Coast Railway Company, see summary, page 286, and report and recommendations of a Board of officers published in the Report of the Chief of Engineers for 1900, pages 1986–2013.

Work under the contract with P. Sanford Ross (Incorporated), entered into December 17, 1903, continued during the year; 9,784.1 cubic yards of coral rock and 4,760.53 tons of granite were placed in the breakwater. The foundation and hearting were extended to station 1400. The granite capping, built to a height of 5 feet above mean low water, was completed to station 1150. A total of 18,393.8 cubic yards of coral rock and 4,760.58 tons of granite have been deposited in the breakwater since the work began. Dredging under this contract began August 12, 1904. At the end of June, 95,699.8 cubic yards of soft material and 10,092.4 cubic yards of rock had been dredged, forming a channel 1,745 feet long, from 120 to 200 feet wide at the top and from 6 to 14 feet deep at mean low water.

The Florida East Coast Railway Company dredged 224,603 cubic yards of soft material during the fiscal year, completing a channel from the wharves at Miami across the bay 90 feet wide and from 10 to 16 feet deep at mean low water, connecting with the work done by the United States from the east side of the bay to the ocean.

Following condemnation proceedings in the circuit court of the United States, fifth judicial circuit, southern district of Florida, under date of January 27, 1905, the United States marshal of said district executed a deed for 42.6 acres of land, including the site of the work of improvement in progress by the United States and shown on the map herewith. The consideration was the sum of $12,780.

On June 30, 1905, the project was about 40 per cent completed.

It is proposed to apply the available balance and the additional appropriation recommended to dredging the channel proposed to a width of 85 feet and to maintenance of the work.

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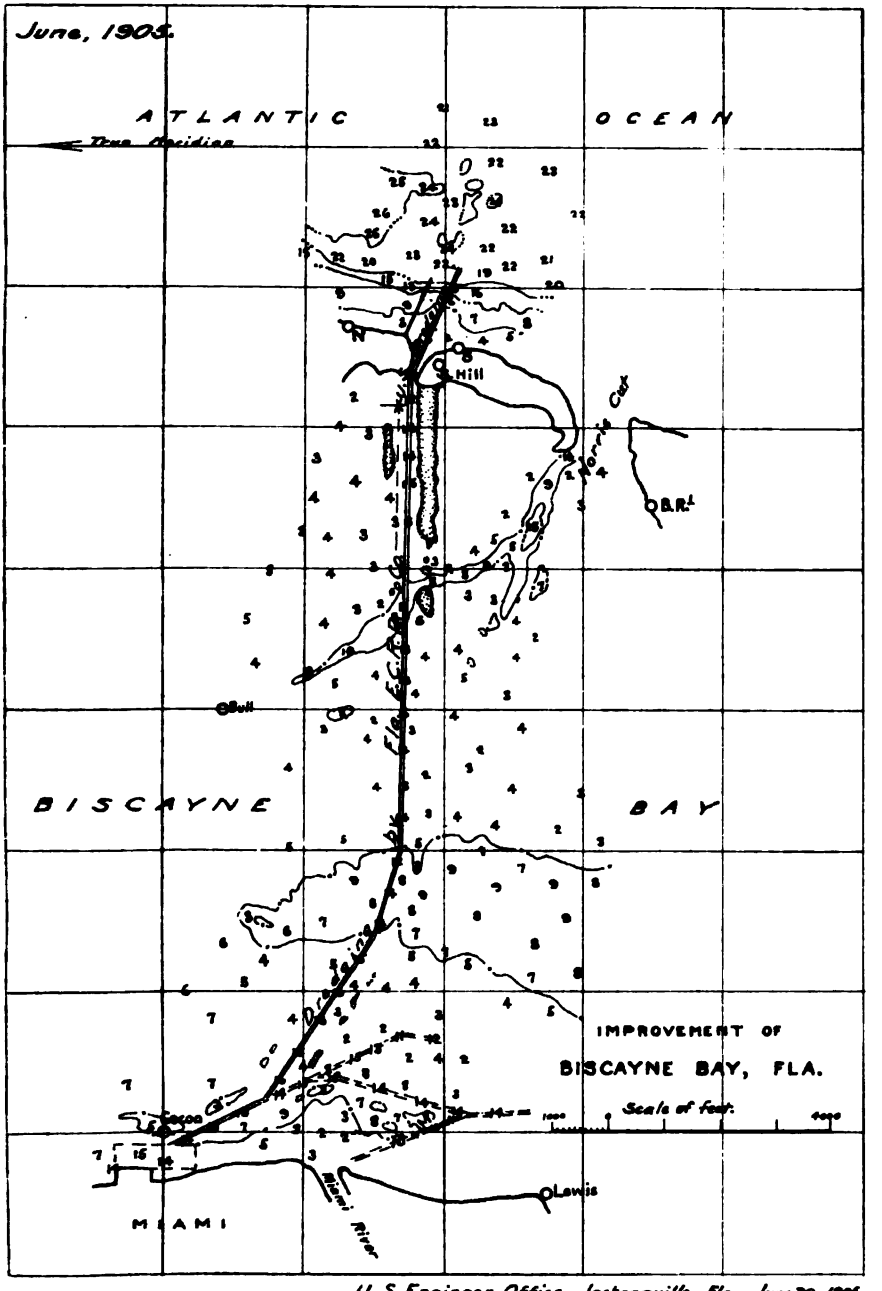

U.S. Engineer Office, Jacksonville Fla., June 30, 1905
To accompany annual report.

Francis Rohrmke
Major, Corps of Engineers U.S.A.

THE HORRIS PETERS CO. PHOTO-LITHO. WASHINGTON, D. C.

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Money statement.

July 1, 1904, balance unexpended [a]	$288,358.01
June 30, 1905, amount expended during fiscal year, for works of improvement	87,125.04
July 1, 1905, balance unexpended	201,232.97
July 1, 1905, outstanding liabilities	40,120.36
July 1, 1905, balance available	161,112.61
July 1, 1905, amount covered by uncompleted contracts	142,753.28
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	25,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

APPROPRIATIONS.

Act of June 13, 1902	$50,000
Act of March 3, 1903	250,000
Total	300,000

CONTRACT IN FORCE DURING THE FISCAL YEAR.

Contractor: P. Sanford Ross (Incorporated).
Work: Dredging and construction of breakwater.
Date: December 17, 1904.
Approved: January 9, 1904.
Date of beginning: March 14, 1904.
Date of completion: March 14, 1906.
Quantities: Dredging—About 154,000 cubic yards of sand, rate 24 cents per cubic yard; 92,000 cubic yards of rock, rate $1.78 per cubic yard. Construction of breakwater—About 4,500 tons of hard rock, at $5.50 per ton; about 17,000 cubic yards of coral rock, at $2.50 per cubic yard.

COMMERCIAL STATISTICS.

Commerce of Biscayne Bay, Florida, during year ending December 31, 1904.

[Furnished by the Board of Trade, Miami, Fla.]

Articles.	Gross tonnage.	Articles.	Gross tonnage.
Fertilizers	2,000	Pineapples	1,500
Fruits	20	Fish and oysters	600
Grain	424	Tobacco	64
Hides	110	Vegetables	1,000
Lumber	3,000	Sash, doors, and blinds	50
Merchandise	8,000		
Oranges	20	Total	16,788

[a] Reduced by $34.49, balance of appropriation for survey, which is not applicable to improvement work.

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Arrivals and departures of vessels for the year ending December 31, 1904.

Kind of vessel.	Arrivals.		Departures.	
	Number.	Tons.	Number.	Tons.
Steamers	200	267,200	200	267,200
Sailing vessels	160	2,560	160	2,560
Yachts	25	.....	25	.....

Estimated number of passengers carried by water	20,000
Estimated percentage of total trade of neighborhood carried by water, per cent	35
Probable increase of trade were the improvement completed, per cent	100

Probable effect on freight rates: Would reduce freight rates.

P 7.

IMPROVEMENT OF HARBOR AT KEY WEST, FLORIDA, AND ENTRANCE THERETO.

For project, description, etc., see summary, page 296, and Reports of the Chief of Engineers for 1896, pages 1325–1327; for 1898, page 1371; for 1900, page 1938; for 1904, pages 1738–1748.

Under authority granted by the Secretary of War April 20, 1903, a seagoing suction dredge was constructed for this work in 1903 and 1904. The working trial of this dredge was made in St. Johns River, Florida, in December, 1904, and January, 1905. The dredge began work on the bar at the northwest entrance to Key West Harbor February 1.

At the end of June 210,509.2 cubic yards of material had been removed from the shoal at the entrance, increasing the available channel depth from 10 feet to 15 feet at mean low water.

The improvement is approximately 30 per cent completed.

It is proposed to apply the available balance and the additional appropriation recommended to dredging in furtherance of the existing project.

Money statement.

July 1, 1904, balance unexpended		$19,732.21
Amount appropriated by river and harbor act approved March 3, 1905		50,000.00
		69,732.21
June 30, 1905, amount expended during fiscal year, for works of improvement		15,435.10
July 1, 1905, balance unexpended		54,297.11
July 1, 1905, outstanding liabilities		3,011.53
July 1, 1905, balance available		51,285.58
Amount (estimated) required for completion of existing project		50,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905		50,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

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APPROPRIATIONS.

August 2, 1882	$25,000.00	June 13, 1902 (rivers and harbors)	$100,000.00
August 5, 1886 (survey)	2,500.00	March 3, 1905	50,000.00
August 11, 1888	25,000.00		
September 19, 1890	40,000.00	Total	512,500.00
July 13, 1892	75,000.00	Received from sales	1.50
August 18, 1894	80,000.00		
June 3, 1896	80,000.00	Aggregate	512,501.50
March 3, 1899	25,000.00		
Allotment from emergency river and harbor act, June 6, 1900	10,000.00		

COMMERCIAL STATISTICS.

Commerce of Key West Harbor, Fla., during the year ending December 31, 1904.

[Furnished by collector of customs, Key West, Fla.]

Articles.	Gross tonnage.	Articles.	Gross tonnage.
Cigars	1,035	Phosphate	72,925
Fertilizers	20	Pineapples	1,000
Fish and oysters	570	Sash, doors, and blinds	600
Fruits	270	Shingles	1,000
Grain	280	Sponge	300
Hay	220	Sirup, honey, etc	5
Hides	1	Tobacco	618
Live stock	9,000	Turpentine and rosin	6
Lumber	6,000	Vegetables	150
Merchandise	80,000	Total	174,305
Oranges	300		

Arrivals and departures of vessels for the year ending December 31, 1904.

Kind of vessel.	Arrivals.		Departures.	
	Number.	Tons.	Number.	Tons.
Steamers	464	565,268	585	675,822
Sailing vessels	189	54,225	153	47,046

Estimated number of passengers carried by water 35,000

Estimated percentage of total trade of neighborhood carried by water, per cent 100

Transportation business established during 1904: McKay Steamship Line.

P 8.

IMPROVEMENT OF KISSIMMEE RIVER, FLORIDA.

For project, description, etc., see summary, page 297, and Report of the Chief of Engineers for 1903, pages 1193–1194.

The river and harbor act of March 3, 1905, appropriated $7,000 for improving Kissimmee River, Florida.

A project for expenditure of available funds was submitted April 20, 1905, and approved April 29, 1905.

Operations on the work of improvement were commenced at the upper end of Southport Canal with the U. S. dredge *Kissimmee* on May 11, 1905, and were in progress on June 30, 1905.

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During the fiscal year there was dredged 3,796.3 cubic yards of soft material, 129.2 cubic yards of rock were removed, and 900 feet of sheet-piling bulkhead was constructed. The money expended for dredging was $655.37; for removal of rock, $284.24, and for bulkhead construction, $800.27. These amounts include all engineering and contingent expenses. The cost of dredging per cubic yard was 17.2 cents; for removal of rock, $2.20 per cubic yard, and for bulkhead construction, 84.2 cents per linear foot.

The approved project was 35 per cent accomplished on June 30, 1905.

It is proposed to apply the available balance and the additional appropriation recommended to completion of the project and maintenance.

Money statement.

July 1, 1904, balance unexpended	$116.70
Amount appropriated by river and harbor act approved March 3, 1905	7,000.00
	7,116.70
June 30, 1905, amount expended during fiscal year, for works of improvement	1,037.11
July 1, 1905, balance unexpended	6,079.59
July 1, 1905, outstanding liabilities	1,000.00
July 1, 1905, balance available	5,079.59
Amount (estimated) required for completion of existing project	9,220.90
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:	
For works of improvement $9,220.90	
For maintenance of improvement 1,000.00	
	10,220.90
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

June 13, 1902	$8,000
March 3, 1905	7,000
Total	15,000

COMMERCIAL STATISTICS.

Commerce of Kissimmee River, Florida, for the year ending December 31, 1904.

[Compiled from information furnished by Capt. Clay Johnson, Kissimmee, Fla.]

Articles.	Gross tonnage.	Articles.	Gross tonnage.
Brick	16	Turpentine	45
Lumber (rough and dressed)	250	Resin	162
Other building materials	100	Oranges and other fruits	200
Fertilizers	200	Groceries	375
Crate materials	200	Vegetables	80
Fish	375	General merchandise (not specified above)	100
Grain	600		
Hay	100	Total	2,883
Hides	60		

Number of steamboats in trade	4
Number of passengers carried in 1904	1,400

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P 9.

IMPROVEMENT OF ORANGE RIVER, CHARLOTTE HARBOR, AND CALOOSAHATCHEE RIVER, FLORIDA.

These improvements were consolidated by the river and harbor act of June 13, 1902. See Report of Chief of Engineers for 1904, pages 1699 and 1700.

The river and harbor act of March 3, 1905, appropriated $3,000 for maintenance of Orange River, Charlotte Harbor, and Caloosahatchee River, Florida.

On April 26, 1905, the following allotment of funds was approved:

To Orange River	$1,000
To Caloosahatchee River	2,000
Total	3,000

(A) ORANGE RIVER.

See summary, page 298, and Reports of Chief of Engineers for 1900, pages 2030–2040; 1903, page 1195; 1904, page 1700.

No work was done during the fiscal year ending June 30, 1905, and no money was expended.

A project for expenditure of available funds was submitted April 15, 1905, and approved April 29, 1905. It is proposed to dredge the shoal places and remove snags, the work to be done by hired labor using a Government dredge.

The approved project was completed in 1903. The work proposed is for maintenance.

It is proposed to apply the additional appropriation recommended to maintenance of the works.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1905	$1,000.00
July 1, 1905, balance unexpended	1,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	1,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(B) CHARLOTTE HARBOR AND CALOOSAHATCHEE RIVER, FROM PUNTARASA TO PUNTA GORDA, FLORIDA.

See summary, page 298, and Report of Chief of Engineers for 1900, pages 2033–2036; for 1903, pages 1195–1196; for 1904, page 1700.

No work was done during the fiscal year ending June 30, 1905, and no money expended.

On April 15, 1905, it was recommended that no allotment be made for maintenance of Charlotte Harbor, the work showing no evidence of deterioration. The recommendation was approved on April 29, 1905.

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The approved project was completed in 1903. As required by section 7 of the river and harbor act of March 3, 1899, it is recommended that no additional appropriation be made as the channel will probably not deteriorate.

(c) CALOOSAHATCHEE RIVER, BETWEEN PUNTARASA AND FORT THOMPSON.

See summary, page 299, and Reports of Chief of Engineers for 1896, pages 1327 and 1328; for 1898, page 1334; for 1903, page 1195; for 1904, page 1701.

No work was done during fiscal year ending June 30, 1905, and no money was expended.

A project for expenditure of available funds was submitted April 15, 1905, and approved April 29, 1905. It is proposed to remove snags in the upper river between Alva and Fort Thompson, the work to be done by hired labor, using a Government dredge.

The approved project was completed in 1901. The work proposed is for maintenance.

It is proposed to use the additional appropriation recommended for maintenance of the works.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1905	$2,000.00
July 1, 1905, balance unexpended	2,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	3,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

Caloosahatchee River, Florida.

August 2, 1882	$5,000	August 18, 1894	$2,000
July 5, 1884	5,000	June 3, 1896	1,000
August 5, 1886	4,000	March 3, 1899	2,000
August 11, 1888	10,000		
September 19, 1890	3,600	Total	33,600
July 13, 1892	1,000		

Charlotte Harbor and Peace Creek, Florida.

September 19, 1890	$35,000
August 18, 1894	20,000
June 3, 1896	20,000
March 3, 1899	25,000
Total	100,000

Orange River, Charlotte Harbor, and Caloosahatchee River, Florida.

June 13, 1902	$9,500
March 3, 1905	3,000
Total	12,500

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COMMERCIAL STATISTICS.

Commerce of Orange River for the year ending December 31, 1904.

[Compiled from information furnished by Messrs. Menge Brothers, Fort Myers, Fla.]

Articles.	Gross tonnage.	Articles.	Gross tonnage.
Lumber (rough and dressed)	98	Other fruits	600
Other building materials	153	Groceries	32
Fertilizers (including phosphates)	400	Vegetables	36
Crate materials	125	General merchandise not specified above	30
Grain	100		
Hay	25	Total	3,699
Oranges	1,500		

Number of steamboats in trade 1
Number of passengers carried in 1904 1,695

Commerce of Charlotte Harbor for the year ending December 31, 1904.

[Compiled from information furnished by Mr. A. F. Dewey, of Punta Gorda, Fla.]

Articles.	Gross tonnage.
Cattle	3,989
Coal	5,160
Phosphates	81,650
Fish and oysters	3,180
General merchandise not specified above	20,500
Total	114,479

Number of steamships and sailing vessels in trade 39

Commerce of Caloosahatchee River for the year ending December 31, 1904.

[Compiled from information furnished by Messrs. Menge Brothers, of Fort Myers, Fla.]

Articles.	Gross tonnage.	Articles.	Gross tonnage.
Lumber (rough and dressed)	125	Groceries	190
Other building materials	25	Vegetables	200
Fertilizers	600	Wood (for fuel)	6,375
Crate materials	375	Oil	28
Fish	150	General merchandise not specified above	10
Oysters	87		
Grain	166	Total	12,255
Hay	50		
Oranges and other fruits	4,000		

Number of steamboats in trade 5
Number of steamships and sailing vessels in trade 2
Number of passengers carried in 1904 3,912

P 10.

IMPROVEMENT OF SARASOTA BAY, FLORIDA.

For description, project, and results see summary, page 300, and Reports of Chief of Engineers for 1896, pages 1331–1332; for 1900, pages 2018–2019; for 1902, pages 1218–1219, and for 1903, page 1197.

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The river and harbor act of March 3, 1905, appropriated $5,000 for continuing improvement of Sarasota Bay, Florida, and for maintenance.

A project for expenditure of available funds was submitted April 14, 1905, and was approved April 22, 1905. It is proposed to do the work of maintenance in the existing channel and to dredge a channel 50 feet wide and 3 feet deep between Osprey and Caseys Pass, the work to be done by hired labor, using a Government dredge.

No work has been done during the fiscal year ending June 30, 1905. No money was expended.

The approved project was 35 per cent completed on June 30, 1905.

It is proposed to expend the appropriation recommended in completing the channel sections in Little Sarasota Bay, in widening the channel sections to full width in Sarasota Bay, and for maintenance of existing channels.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1905		$5,000.00
July 1, 1905, balance unexpended		5,000.00
Amount (estimated) required for completion of existing project		27,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$18,000.00	
For maintenance of improvement	2,000.00	
		20,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

APPROPRIATIONS.

September 19, 1890	$5,000	June 13, 1902	$5,000
July 13, 1892	2,500	March 3, 1905	5,000
August 18, 1894	2,500		
June 3, 1896	2,500	Total	27,500
March 3, 1899	5,000		

COMMERCIAL STATISTICS.

Commerce of Sarasota Bay, Florida, for the year ending December 31, 1904.

[Compiled from information furnished by the Sarasota Board of Trade.]

Articles.	Gross tonnage.	Articles.	Gross tonnage.
Brick	520	Resin	2,160
Lumber (rough and dressed)	500	Oranges	500
Other building materials	25	Other fruits	800
Coal	50	Groceries	250
Fertilizers	250	Vegetables	240
Crate materials	50	Wood (for fuel)	18,750
Fish	125	Oil	1
Oysters	150	General merchandise not specified above	1,000
Grain	100	Wines and liquors	3
Hay	100		
Hides	5		
Turpentine	400	Total	25,479

Number of steamboats in trade	2
Number of sailing vessels in trade	6
Number of passengers carried in 1904	500

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P 11.

IMPROVEMENT OF TAMPA BAY, FLORIDA.

For description, project, and results, see summary, page 293, and Reports of the Chief of Engineers for 1899, pages 1632–1635; for 1900, pages 2022–2025; for 1902, pages 1219–1221, and for 1903, pages 1198–1199.

The project adopted March 3, 1899, was modified by the river and harbor act of March 3, 1905. The project as modified contemplates securing a channel depth of 26 feet, with sufficient width, from the Gulf of Mexico to Port Tampa.

No work has been done during the fiscal year ending June 30, 1905. The money expended was for contingent expenses and for completion of the U. S. dredge *Key West*.

The approved project was 55 per cent completed on June 30, 1905.

It is proposed to apply the available funds to widening and deepening the channel sections whenever the Atlantic Land and Improvement Company, owning terminals at Tampa Bay, agree, by valid contract, that the wharfage charges at such terminals shall be submitted to the Secretary of War and be subject to his approval, as is required by the river and harbor act of March 3, 1905.

Money statement.

July 1, 1904, balance unexpended	$277,631.01
June 30, 1905, amount expended during fiscal year, for works of improvement	[a] 15,415.83
July 1, 1905, balance unexpended	262,215.18
July 1, 1905, outstanding liabilities	7.00
July 1, 1905, balance available	262,208.18
Amount (estimated) required for completion of existing project	139,987.24
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	139,987.24

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

APPROPRIATIONS.

Under previous projects.

June 14, 1880	$10,000.00	August 11, 1888	$25,000.00
March 3, 1881	10,000.00	September 19, 1890	25,000.00
August 2, 1882	20,000.00	July 13, 1892	10,000.00
July 5, 1884	20,000.00		
August 5, 1886	10,000.00	Total	130,000.00

Under present project.

March 3, 1899	$75,000.00
June 6, 1900	135,000.00
March 3, 1901	127,000.00
June 28, 1902	86,675.00
March 3, 1903	186,337.76
Total	610,012.76

[a] Includes $8,500 allotted for construction *Key West*, dredge.

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COMMERCIAL STATISTICS.

Commerce of Tampa Bay for the year ending December 31, 1904.

[Compiled from information furnished by the Atlantic Land and Improvement Company.]

Articles.	Gross tonnage.	Articles.	Gross tonnage.
Lumber (rough and dressed)	8,276	Other fruits	7
Other building materials	450	Groceries	2,750
Cattle	8	Vegetables	544
Coal	2,044	Wood for fuel	10
Fertilizers, including phosphates	476,893	Oil	11,760
Crate materials	190	General merchandise	65,539
Fish	387	Wines and liquors	79
Grain	17,537	Sugar	1,340
Hay	199	Tobacco in bales	2,360
Turpentine	66	Imported cigars in cases	116
Resin	34		
Oranges	592	Total	591,181

Number of steamboats cleared	112
Number of steamships and sailing vessels cleared	360
Number of passengers carried in 1904	25,132

P 12.

IMPROVEMENT OF HILLSBORO BAY, FLORIDA.

For description, projects, and results see summary, page 302, and Reports of the Chief of Engineers for 1899, pages 1635–1637; for 1900, pages 2025–2027; for 1902, pages 1222–1223, and for 1903, pages 1200–1201.

The dredging contract with Mr. Edwin W. Preston, dated October 13, 1902, was annulled on May 7, 1904, and the work was readvertised on June 20, 1904. Bids for completion of the work were opened on July 21, 1904, and rejected on account of being too high. On August 5, 1904, the work was authorized to be done by hired labor, using the U. S. dredge *Suwanee*. Dredging was commenced on September 27, 1904, and operations ceased on March 10, 1905, on account of the available funds being exhausted. There was removed 74,389 cubic yards of soft material, at a cost of $17,040.98, being about 23.67 cents per cubic yard.

A new project was adopted March 3, 1905, by the following item of the river and harbor act of that date:

Improving Hillsboro Bay, Florida, in accordance with the report submitted in House Document Numbered Three hundred and six, Fifty-eighth Congress, second session, with a view to obtaining a depth of twenty feet from the lower bay to the mouth of Hillsboro River, one hundred thousand dollars: *Provided*, That a contract or contracts may be entered into by the Secretary of War for such materials and work as may be necessary to complete said portion of the project recommended in said report, to be paid for as appropriations may from time to time be made by law, not to exceed in the aggregate three hundred and forty-eight thousand three hundred and fifty dollars, exclusive of the amounts herein and heretofore appropriated: *Provided, further*, That such improvement shall not include that portion of the said project located in Hillsboro Bay.

Advertisements were published on June 1, 1905, inviting proposals for the work authorized.

An allotment of $10,000 from the available funds was made on April 3, 1905, for completing the 12-foot channel in Hillsboro Bay to its full width of 150 feet, the work to be done by hired labor, using a Government dredge. Work was commenced by the U. S. dredge *Suwanee* on April 10, 1905, and at the end of the fiscal year, on June

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30, 1905, there has been removed 40,386 cubic yards of soft material, at a cost of 15.8 cents per yard.

The work of widening the 12-foot channel to width of 150 feet was 80 per cent completed on June 30, 1905.

It is proposed to expend the appropriation recommended in completing the approved project.

Money statement.

July 1, 1904, balance unexpended	$28,587.80
Amount appropriated by river and harbor act approved March 3, 1905	100,000.00
Amount deposited sale of old material	9.30
	128,597.10
June 30, 1905, amount expended during fiscal year, for works of improvement	34,181.80
July 1, 1905, balance unexpended	94,415.50
July 1, 1905, outstanding liabilities	2,500.00
July 1, 1905, balance available	91,915.50
Amount (estimated) required for completion of existing project	348,350.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	348,350.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

APPROPRIATIONS.

A list of appropriations made for previous projects in this locality is given in the report for the improvement of Tampa Bay in the Annual Report of the Chief of Engineers for 1899, page 1634.

Under present project, by act of March 3, 1899	$125,000
Under present project, by act of June 13, 1902	150,000
Under present project, by act of March 3, 1905	100,000
Total	375,000

COMMERCIAL STATISTICS.

Commerce of Hillsboro Bay for the year ending December 31, 1904.

[Compiled from information furnished by the Tampa Board of Trade.]

Articles.	Gross tonnage.	Articles.	Gross tonnage.
Brick	5,100	Naval stores	8,570
Building materials	2,135	Oranges	11,350
Canned goods	6,800	Other fruits	2,750
Cattle	3,480	Oysters	410
Coal	17,200	Shingles	5,250
Crate materials	1,520	Sidewalk material	21,200
Fertilizers	18,200	Soap, starch, etc	4,870
Fish	6,500	Sugar	2,350
Fuller's earth	11,870	Timber	8,600
Grain (including feed and mill stuff)	61,310	Tropical fruits (in bulk)	2,300
Hay	7,980	Vegetables	9,100
Hides	190	Wood and boiler fuel	10,875
Honey, sirup, etc	114	Tobacco in bales	5
Lumber (rough and dressed)	23,290		
Merchandise, not specified	21,600	Total	274,399

Number of steamboats engaged in trade	16
Number of sailing vessels in trade (not including sharpies and fishing schooners)	46
Number of passengers carried in 1904	33,700

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P 13.

IMPROVEMENT OF CRYSTAL, ANCLOTE, SUWANEE, AND WITHLACOOCHEE RIVERS, FLORIDA.

These improvements and the improvement of Manatee River were consolidated by the river and harbor act of June 13, 1902. See Report of the Chief of Engineers for 1904, pages 1707–1712.

The river and harbor act of March 3, 1905, made separate provision for Manatee River. The item in the act relating to the four other rivers is as follows:

Improving Crystal, Anclote, Suwanee, and Withlacoochee rivers, Florida: Continuing improvement and for maintenance, forty thousand dollars, of which amount the sum of fifteen thousand dollars each may be expended on the Crystal and Withlacoochee, and five thousand dollars each on the Anclote and Suwanee rivers.

(A) CRYSTAL RIVER.

For description, project, and survey report see summary, page 304, and Report of Chief of Engineers for 1900, pages 2075–2078.

The following project for expenditure of available funds was approved on May 1, 1905:

To dredge a channel 60 feet wide and 6 feet deep through the most obstructive shoals which are between the mouth of the river and the 6-foot contour in the Gulf of Mexico, and to deepen such portions of the channel already dredged as may be found to be less than 6 feet in depth. The work to be done by hired labor, using a Government dredge.

No work was done during the fiscal year ending June 30, 1905, and no money was expended.

The project was 15 per cent completed on June 30, 1905.

It is proposed to expend the appropriation recommended in continuing the work of improvement.

Money statement.

July 1, 1904, balance unexpended	$1,892.49
Amount appropriated by river and harbor act approved March 3, 1905	15,000.00
	16,892.49
June 30, 1905, amount expended during fiscal year, for works of improvement	[a] 1,892.49
July 1, 1905, balance unexpended	15,000.00
Amount (estimated) required for completion of existing project	59,647.46
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	20,000.00

(B) ANCLOTE RIVER.

For description, project, and results, see summary, page 305, and Reports of the Chief of Engineers for 1895, pages 1573–1576; for

[a] Construction of dredge *Florida*.

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1898, pages 1361–1363; for 1900, pages 2028–2029; for 1902, page 1223, and for 1903, page 1203.

At the beginning of the fiscal year the U. S. dredge *Suwanee* was at work in the channel and continued operations until July 16, 1904, when the available funds were exhausted. There was dredged 8,221.6 cubic yards of soft material, at a total cost of $712.01. The cost per cubic yard was 8.7 cents.

The following project for expenditure of available funds was approved on May 1, 1905:

To dredge a channel 50 feet wide and 4 feet deep from the upper end of the existing channel to the county bridge at Tarpon Springs, and to extend the channel already dredged between Anclote Anchorage and Sponge Harbor to such width as the funds may permit. The work is to be done by hired labor, using a Government dredge.

The approved project was 43 per cent completed on June 30, 1905.

It is proposed to expend the appropriation recommended in continuing the improvement by widening the channel sections between Anclote anchorage and the county bridge at Tarpon Springs.

Money statement.

July 1, 1904, balance unexpended	$4,410.52
Amount appropriated by river and harbor act approved March 3, 1905	5,000.00
	9,410.52
June 30, 1905, amount expended during fiscal year, for works of improvement	[a]4,410.52
July 1, 1905, balance unexpended	5,000.00
Amount (estimated) required for completion of existing project	31,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	20,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(c) SUWANEE RIVER.

For description, project, and results, see summary, page 305, and Reports of the Chief of Engineers for 1896, pages 1335–1336; for 1898, pages 1341–1342; for 1902, pages 1223–1224, and for 1903, page 1203.

On May 1, 1905, the recommendation was approved that an examination be made of the river with a view of ascertaining those portions where money may most profitably be expended, and after such examination to submit a more definite project for the expenditure of the present appropriation.

The examination was made June 27–30, 1905.

The project was 86 per cent completed on June 30, 1905.

No work was done during the fiscal year ending June 30, 1905. The money expended was for contingencies and construction of the U. S. dredge *Florida*.

[a] Includes $2,700 allotted for construction of dredge *Florida*.

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Money statement.

July 1, 1904, balance unexpended	$6,363.80
Amount appropriated by river and harbor act approved March 3, 1905	5,000.00
	11,363.80
June 30, 1905, amount expended during fiscal year, for works of improvement	2,385.52
July 1, 1905, balance unexpended	8,978.28

(D) WITHLACOOCHEE RIVER.

For description, survey, projects, and results, see summary, page 306, and Reports of the Chief of Engineers for 1898, pages 1340–1341 and 1363–1369; for 1902, page 1224, and for 1903, page 1203.

No work was done under the old project. The money expended was for construction of the U. S. dredge *Florida*.

Bids were opened on July 16, 1904, for operations under the provision of the river and harbor act of June 13, 1902. Contract was entered into with Mr. A. G. Bigelow on August 27, 1904, which was approved September 12, 1904. The price for dredging soft material was 16 cents per cubic yard, and for removing rock, $2.50 per cubic yard. The work was commenced on October 27, 1904, and was completed on May 19, 1905. There was removed 8,279 cubic yards of soft material and 4,073.9 cubic yards of rock.

The following project for expenditure of available funds was approved on May 1, 1905:

To widen to 100 feet and deepen to 8 feet at mean low water the channel between the outer oyster reef and the loading pool in the Gulf of Mexico, and in maintenance of existing channels. Proposals to be invited in the usual manner for undertaking the work by contract.

Advertisements were published on June 12, 1905, inviting proposals for operations under the provision of the river and harbor act of March 3, 1905.

There was expended $14,500 during the fiscal year ending June 30, 1905.

It is proposed to apply the available funds in continuing the work of improvement.

Money statement.

OLD PROJECT.

July 1, 1904, balance unexpended	$5,296.38
June 30, 1905, amount expended during fiscal year, for works of improvement	[a] 5,296.38

NEW PROJECT.

July 1, 1904, balance unexpended	$14,500.00
Amount appropriated by river and harbor act approved March 3, 1905	15,000.00
	29,500.00
June 30, 1905, amount expended during fiscal year, for works of improvement	14,500.00
July 1, 1905, balance unexpended	15,000.00

[a] Allotted for the construction of the dredge *Florida*.

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APPROPRIATIONS.

Crystal River.

June 13, 1902 (allotted)	$10,000
March 3, 1905 (allotted)	15,000
Total	25,000

Anclote River.

March 3, 1899	$5,000
June 13, 1902 (allotted)	10,000
March 3, 1905 (allotted)	5,000
Total	20,000

Withlacoochee River.

March 3, 1881	$7,500	June 13, 1902	$15,000
July 5, 1884	3,000	June 13, 1902 (allotted)	5,000
August 5, 1886	3,000	March 3, 1905 (allotted)	15,000
August 11, 1888	5,000		
September 19, 1890	5,400	Total	59,700
August 18, 1894	800		

Suwanee River.

June 14, 1880	$5,000.00	August 18, 1894	$3,000.00
March 3, 1881	3,000.00	June 3, 1896	3,000.00
August 2, 1882	5,000.00	March 3, 1899	5,000.00
July 5, 1884	5,000.00	June 13, 1902 (allotted)	7,658.00
August 5, 1886	5,000.00	March 3, 1905 (allotted)	5,000.00
August 11, 1888	15,000.00	For rent of dredge	78.90
September 19, 1890	3,000.00		
July 13, 1892	3,000.00	Total	67,736.90

CONTRACT IN FORCE.

Contractor: Alexander G. Bigelow.
Work: Dredging Withlacoochee River entrance.
Date: August 27, 1904.
Approved: September 12, 1904.
Date of beginning: October 15, 1904.
Date of completion: June 15, 1905.
Quantities: Rock, 3,600 cubic yards, at $2.50; sand, etc., 17,000 cubic yards, at 16 cents.

COMMERCIAL STATISTICS.

Commerce of Crystal River for the year ending December 31, 1904.

[Compiled from information furnished by Mr. C. E. Herrick, of Crystal River, Fla.]

Articles.	Gross tonnage.	Articles.	Gross tonnage.
Lumber (rough and dressed)	1,250	General merchandise not specified above	100
Fish	100	Cedar logs in rafts and schooners	5,000
Oysters	375		
Grain	33	Total	6,875
Hay	15		
Groceries	2		

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Commerce of Anclote River for the year ending December 31, 1904.

[Compiled from information furnished by Mr. John K. Cheyney, Tarpon Springs, Fla.]

Articles.	Gross tonnage.	Articles.	Gross tonnage.
Brick	65	Oranges	450
Lumber (rough and dressed)	2,000	Other fruits	225
Other building materials	35	Groceries	250
Shingles	50	Vegetables	80
Fertilizers	100	Wood (for fuel)	1,000
Crate materials	70	Oil (for fuel)	80
Fish	24	General merchandise not specified above	25
Oysters	56	Oyster shells for paving	2,250
Grain	120	Sponges	a 120
Hay	150		
Turpentine	200		
Resin	980	Total	8,310

a This item was valued at $360,000.

Number of steamboats in trade	1
Number of sailing vessels in trade	226
Number of passengers carried in 1904	1,400
Number of gasoline launches	30

Commerce of Suwanee River for the year ending December 31, 1904.

[Compiled from information furnished by Capt. M. Currie, of the steamer *City of Hawkinsville,* Cedar Keys, Fla.]

Articles.	Gross tonnage.	Articles.	Gross tonnage.
Brick	308	Turpentine	400
Lumber (rough and dressed)	1	Resin	5,040
Other building materials	25	Oranges	2
Fertilizers	175	Other fruits	6
Fish	50	Groceries	1,250
Grain	156		
Hay	225	Total	7,658
Hides	20		

Number of steamboats in trade, 2.

Commerce of Withlacoochee River for the year ending December 31, 1904.

[Compiled from information furnished by Mr. John L. Inglis, president of the Dunnellon Phosphate Company, Dunnellon, Fla.]

Articles.	Gross tonnage.	Articles.	Gross tonnage.
Brick	32	Hay	105
Lumber (rough and dressed)	775	Wood for fuel	2,675
Coal	1,810	General merchandise (not specified above)	115
Phosphate, hard rock	117,787		
Fish	88		
Oysters	2	Total	123,389
Grain	35		

Number of steamboats in trade	5
Number of steamships in trade	42
Number of sailing vessels in trade	8
Number of passengers carried in 1904	1,560
Number of barges (seagoing) in trade	11
Number of house boats	2

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P 14.

IMPROVEMENT OF MANATEE RIVER, FLORIDA.

For description, project, and results see summary, page 307, and Reports of Chief of Engineers for 1896, pages 1332–1333; for 1900, pages 2020–2021; for 1902, page 1223; for 1903, page 1203; for 1904, pages 1707–1709.

A new project was adopted March 3, 1905, by the following item of the river and harbor act of that date:

Improving Manatee River, Florida, in accordance with the report submitted in House Document Numbered One hundred and seventeen, Fifty-eighth Congress, second session, ten thousand dollars.

Estimated cost of the project is $53,710.

The following project for expenditure of available funds was approved on April 29, 1905:

To dredge through the shoals between Ellenton and Rocky Bluff a channel 7 feet deep and 100 feet wide, and through the shoals between Rocky Bluff and Rye a channel 4 feet deep at low mean water and 65 feet wide; the work to be done by hired labor, using a Government dredge.

No work was done during the fiscal year ending June 30, 1905, and no money was expended.

It is proposed to expend the appropriation recommended in continuing the work of improvement.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1905		$10,000.00
July 1, 1905, balance unexpended		10,000.00
Amount (estimated) required for completion of existing project		70,710.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$17,000.00	
For maintenance of improvement	2,500.00	
		19,500.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

APPROPRIATIONS.

August 2, 1882	$12,000	March 3, 1899 ($8,000 for Terraceia Cut-off)	$10,000
August 5, 1886	11,000	June 13, 1902 (allotted for Terraceia Cut-off)	2,342
August 11, 1888	5,000	March 3, 1905	10,000
September 19, 1890	6,000		
July 13, 1892	6,000	Total	69,342
August 18, 1894	3,000		
June 3, 1896 ($3,000 for Terraceia Cut-off)	4,000		

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COMMERCIAL STATISTICS.

Commerce of Manatee River for the year ending December 31, 1904.

[Compiled from information furnished by the Independent Line Steamers, Tampa, Fla.]

Articles.	Gross tonnage.	Articles.	Gross tonnage.
Lumber (rough and dressed)	1,750	Hides	1
Other building materials	1,200	Turpentine	80
Cattle	400	Resin	168
Coal	450	Oranges	7,500
Fertilizers, including phosphates	8,500	Vegetables	10,000
Crate materials (excluding fruits)	1,250	General merchandise not specified above	5,000
Fuller's earth	10,000		
Grain	183	Total	46,517
Hay	85		

Number of steamboats in trade	5
Number of sailing vessels in trade	12
Number of passengers carried in 1904	35,000

P 15.

REMOVING THE WATER HYACINTH FROM FLORIDA WATERS.

For original condition, project, etc., see current summary, page 308, and Reports of the Chief of Engineers for 1899, pages 1612–1623; for 1901, pages 1746–1749; for 1903, pages 1184–1186; for 1904, pages 1712–1713.

Under date of May 31, 1904, the Secretary of War allotted $25,000 from the emergency river and harbor act of April 28, 1904, for continuing the work. Operations under this allotment began July 27, 1904, and ceased November 26, owing to exhaustion of funds.

This work resulted in the destruction of an aggregate area of about 6,977,000 square yards of the hyacinth, using 605,833 gallons of spraying compound. The river and its tributaries were practically cleared of the plant for a distance of 20 miles above Palatka and 15 miles below that place. No obstruction to navigation was reported in other portions of the river.

The river and harbor act of March 3, 1905, appropriated $25,000 for this work, but provided that "no chemical process injurious to cattle which may feed upon the water hyacinth shall be used." No process has yet been disclosed which will compare favorably with the spraying method, using a solution of arsenic and soda. It has been recommended that the Department of Agriculture undertake such experiments as may be necessary to determine whether this solution, applied in the customary manner, is injurious to cattle. Until this question has been decided, no work is proposed with the funds provided in the last appropriation.

It is impracticable to determine what portion of this project has been completed owing to the intermittent progress of the work.

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Money statement.

July 1, 1904, balance unexpended	[a] $27,032.65
Amount appropriated by river and harbor act approved March 3, 1905	25,000.00
	52,032.65
June 30, 1905, amount expended during fiscal year, for works of improvement	26,010.62
July 1, 1905, balance unexpended	26,022.03
July 1, 1905, outstanding liabilities	50.00
July 1, 1905, balance available	25,972.03
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	100,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

Act of March 3, 1899:	
For construction of boat	$25,000
For log booms	1,000
For operating expenses	10,000
Act of June 13, 1902:	
For removal of the water hyacinth from the navigable waters of the States of Florida, Texas, and Louisiana, $50,000; allotted for Florida	25,000
Emergency river and harbor act of April 28, 1904	25,000
Act of March 3, 1905:	
For removing water hyacinth from the navigable waters of Florida	25,000
Total	111,000

P 16.

DREDGE FOR RIVER AND HARBOR IMPROVEMENTS, FLORIDA.

See Report of the Chief of Engineers for 1901, pages 1749–1750.

A contract with the Merrill-Stevens Engineering Company, Jacksonville, Fla., for the construction of the boat (the *Florida*) was approved July 11, 1903. Work began without delay and the hull was launched April 2, 1904. The boat was received from the contractors March 27, 1905, and began dredging at Volusia bar April 4, 1905. The work at that place, on the upper St. Johns River and on the Oklawaha River was completed, the wreck of the steamer *Starlight* in Lake Monroe was removed, and the boat arrived at Jacksonville to prepare for work on Indian River on June 29.

Some minor defects were disclosed during the working trial. These were remedied by the builders and the boat was accepted, and final payment was made on June 8, 1905.

The work of the boat has been very satisfactory and it is believed that it will answer the purpose for which it was designed in every way desired.

[a] Includes $25,000 from emergency river and harbor act of April 28, 1904.

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Money statement.

July 1, 1904, balance unexpended	$51,729.53
June 30, 1905, amount expended during fiscal year, for works of improvement	51,729.53

APPROPRIATIONS.

Act of March 3, 1899	$35,000
Act of June 13, 1902	35,000
Total	70,000

CONTRACT IN FORCE DURING THE FISCAL YEAR.

Contractor: Merrill-Stevens Engineering Company.
Work: Construction of combined dredge and snag boat.
Date: May 20, 1903.
Approved: July 11, 1903.
Date of beginning: September 16, 1903.
Date of completion: September 16, 1904.
Amount: $61,404.50.

P 17.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

The wreck of the steamer *Starlight* in Lake Monroe, Florida, was removed May 12 to 15, 1905, by the U. S. dredge and snag boat *Florida*. The wreck was removed to a depth of 6 feet and more below extreme low water, a greater depth not being required by vessels navigating those waters. The *Starlight* was a side-wheel passenger steamer, wooden hull, 135 feet long, 22 feet beam, and 5 feet deep. In 1877 the boat caught fire at Sanford, on Lake Monroe, and, after burning to the water's edge, drifted out into the lake and sank at a point NE. ½ N. three-fourths of a mile from the present Clyde wharf.

On June 15, 1905, bids were opened for the removal of the wrecks *Ridgewood* and *Commodore Barney*, in St. Johns River, Florida. The lowest bid received was that of Charles W. Johnston, of Lewes, Del., the amount being $2,490. On June 29 contract was sent to the bidder for signature.

The *Ridgewood* was a two-masted schooner, 180 tons burden, 130 feet long, and 35 feet beam. The schooner caught fire in the summer of 1901, when about half loaded with lumber, at what is now known as McGuire's mill. The vessel was cut adrift and finally lodged against the remains of an old wharf about three-fourths of a mile below the mill.

The *Commodore Barney* was a side-wheel, double-end, ferryboat of 838 gross tons, 143.6 feet long, 33.9 feet beam, and 12.2 feet draft. She was launched in 1859. She sank in the slip at Jacksonville, Fla., in October, 1901, and was raised and suspended in slings. In this position the upper work was cut away to the deck, the guards trimmed away to the hull, and all machinery excepting the boiler removed. She was then taken to the south side of the river, where the slings parted and the boat settled to the bottom in about 17 feet of water 500 feet below the Florida East Coast Railway bridge.

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APPENDIX Q.

IMPROVEMENT OF RIVERS AND HARBORS IN WESTERN GEORGIA AND FLORIDA AND IN EASTERN ALABAMA.

REPORT OF CAPT. J. B. CAVANAUGH, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1905, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Carrabelle Bar and Harbor, Florida.
2. Apalachicola Bay, Florida.
3. Apalachicola River, the Cut-off, and Chipola River, Florida.
4. Flint River, Georgia.
5. Chattahoochee River, Georgia and Alabama.
6. Choctawhatchee River, Florida and Alabama.
7. Holmes River, Florida, from Vernon to its mouth.
8. Blackwater River, Florida.
9. Pensacola Harbor, Florida.
10. Escambia and Conecuh rivers, Florida and Alabama.
11. Alabama River, Alabama.
12. Coosa, Oostenaula, and Coosawattee rivers, Georgia and Alabama.
13. Operating and care of canals and other works of navigation on Coosa River, Georgia and Alabama.
14. Removing sunken vessels or craft obstructing or endangering navigation.

SURVEY.

15. Coosa and Alabama rivers, Georgia and Alabama.

UNITED STATES ENGINEER OFFICE,
Montgomery, Ala., July 20, 1905.

GENERAL: I have the honor to forward herewith * * * annual reports of the river and harbor works under my charge * * * for the fiscal year ending June 30, 1905.

* * * * * * *

Very respectfully, your obedient servant,

J. B. CAVANAUGH,
Captain, Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

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Q 1.

IMPROVEMENT OF EAST PASS CARRABELLE BAR AND HARBOR, FLORIDA.

A description of the locality, its original condition, the projects for improvement, the recommendations resulting from recent examinations and surveys, and the present condition of the channel across the bar at the river mouth and at East Pass are stated in the Annual Report of the Chief of Engineers for 1905, page 310.

Work done prior to June 30, 1900, will be found described on pages 2088–2089, Annual Report of the Chief of Engineers for 1900.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1905.

Under contract with Rittenhouse Moore, entered into October 1, 1903, dredging at East Pass was commenced August 8, 1904, and completed September 9, 1904; 60,080 cubic yards of material were removed, at 30 cents per cubic yard, 38,480 cubic yards from the outer bar, which was deepened from 17 to 20 feet, and 21,600 cubic yards from the inner bar, which was deepened from 16.5 to 17.5 feet. The actual increase in available depth was nearly 2 feet, as a tortuous channel around the inner bar has a depth of about 19 feet and is used for the deepest draft vessels.

Under an allotment of $7,500, made June 25, 1904, from the appropriation for emergencies in river and harbor works, act of June 13, 1902, proposals were invited for redredging the channel across the bar at the mouth of Carrabelle River on July 5, 1904, and contract entered into August 9, 1904, with Charles W. Eaton for doing the work, at 24 cents per cubic yard. On November 14, 1904, an additional allotment of $5,000 was made from the appropriation for emergencies in river and harbor works, act of April 28, 1904, and supplemental articles of agreement entered into November 26, 1904, with Mr. Eaton to do the additional work at the same price. Under this contract, work was commenced October 15, 1904, and completed February 15, 1905, 46,681 cubic yards of material being removed, completing the channel to a width of 80 feet and a minimum depth of 8 feet. At points where fill from storm quarter may be expected, the depth was made 1 to 2 feet greater, the average depth being over 9 feet.

RECOMMENDATIONS AND ESTIMATES.

The completion of work upon the bar at the river mouth and the deepening of East Pass are important to both present and prospective commerce. The vessels now touching at Carrabelle and the tugs used in lightering between Carrabelle and St. George anchorage find the narrow, shallow channel very difficult of navigation, and relief is badly needed. The increased depth of water through East Pass will secure much better rates of freight and insurance for the commerce now using Carrabelle Harbor, and much better inducements will be offered to prospective commerce. I am informed that the better railroad facilities recently secured and the very favorable railroad rates that have been offered will insure a largely increased commerce as a result of the improvement of the harbor and channel.

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The channel across the bar at the mouth of the river should, therefore, be completed to the depth of 10 feet, with a width of 100 feet throughout, and East Pass should be deepened to 20½ feet, as contemplated in the approved project.

It is proposed to expend the balance available in redredging the channel across the bar at the mouth of Carrabelle River to a depth of 10 feet and as near the projected width as funds permit, the work to be done by contract, and to apply the additional appropriation recommended to deepening East Pass and to dredging and maintaining a channel across the bar at the mouth of the Carrabelle River to the full projected width and depth.

Money statement.

July 1, 1904, balance unexpended		$26,804.54
Amount appropriated by river and harbor act approved March 3, 1905		15,000.00
Amount allotted from appropriation for maintenance of river and harbor improvements, act of April 28, 1904		5,000.00
		46,804.54
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$18,000.00	
For maintenance of improvement	13,694.97	
		31,694.97
July 1, 1905, balance unexpended		15,109.57
July 1, 1905, outstanding liabilities		37.20
July 1, 1905, balance available		15,072.37
Amount (estimated) required for completion of existing project		45,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$45,000.00	
For maintenance of improvement	7,500.00	
		52,500.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

APPROPRIATIONS.

June 3, 1896	$10,000.00	April 28, 1904 (allotment made November 4, 1904)	$5,000.00
March 3, 1899	10,000.00	March 3, 1905	15,000.00
June 6, 1900 (allotment)	1,704.08		
June 13, 1902	20,000.00	Total	69,204.08
June 13, 1902 (allotment made June 25, 1904)	7,500.00		

Q 2.

IMPROVEMENT OF HARBOR AT APALACHICOLA BAY, FLORIDA.

A description of this locality, its original and present conditions, and the project for improvement are given in the Annual Report of the Chief of Engineers for 1905, page 311.

Work done prior to June 30, 1903, is described in the Annual Reports of the Chief of Engineers for 1900, pages 2092–2095, and 1903, pages 1209–1210.

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OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1905.

Under contract with Rittenhouse Moore, entered into October 1, 1903, dredging at West Pass was commenced September 12, 1904, and completed November 10, 1904. Sixty thousand and twenty cubic yards of material were removed, all from the outer bar, which was deepened from 13 to 16 feet at mean low water, this limiting depth being confined to the crest of the bar. No benefit to commerce resulted from this work, due to the fact that the depth obtained was not sufficient to enable vessels to use this entrance.

Under an allotment of $12,500, made May 31, 1904, from the appropriation for emergencies in river and harbor works, act of April 28, 1904, proposals were invited on July 5, 1904, and contract entered into August 9, 1904, with Charles W. Eaton for redredging the channel across the bar at the mouth of the Apalachicola River, at 24 cents per cubic yard. On September 14, 1904, an additional allotment of $5,000 was made from the same appropriation for completing the work, and supplemental articles of agreement were entered into with Mr. Eaton on September 15, 1904, to do the additional work required, at the price of 22 cents per cubic yard. Under this contract work was commenced August 17, 1904, and completed October 12, 1904. Sixty-eight thousand cubic yards of material were removed, completing the channel to a width of 80 feet and minimum depth of 9 feet at mean low water.

RECOMMENDATIONS AND ESTIMATES.

The existing commerce of Apalachicola requires that the West Pass entrance be opened and a good barge channel connect West Pass anchorage with the city, and that these channels be maintained. As a revision of the present project is under consideration, the recommendations and estimates have been restricted for the present to these minimum requirements.

The appropriations thus far made have been insufficient and have all been practically absorbed in maintenance, the work accomplished on the adopted project not exceeding $20,000 in amount.

It is proposed to expend the balance available in dredging the channel across the bar at West Pass entrance to Apalachicola Bay and Link channel and to apply the additional appropriation recommended to completing and maintaining this channel and to dredging the channel at the mouth of the Apalachicola River to a width not less than 100 feet and a depth not less than 10 feet at mean low water.

Money statement.

July 1, 1904, balance unexpended	$31,899.85
Amount appropriated by river and harbor act approved March 3, 1905	40,000.00
Amount allotted from appropriation for maintenance of river and harbor improvements, act of April 28, 1904	5,000.00
	76,899.85
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	36,786.17
July 1, 1905, balance unexpended	40,113.68
July 1, 1905, outstanding liabilities	43.30
July 1, 1905, balance available	40,070.38

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Amount (estimated) required for completion of existing project	$300,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:	
For works of improvement	$40,000.00
For maintenance of improvement	35,000.00
	75,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

March 2, 1833	$8,700	
July 4, 1836	10,000	
March 3, 1839	9,900	
		$28,600
June 14, 1880	10,000	
March 3, 1881	10,000	
August 2, 1882	25,000	
July 5, 1884	10,000	
August 5, 1886	12,000	
August 11, 1888	20,000	
September 19, 1890	20,000	
July 13, 1892	20,000	
August 18, 1894	15,000	
June 3, 1896	12,000	
		154,000
March 3, 1899	20,000	
June 13, 1902	40,000	
April 28, 1904 (allotment)	12,500	
April 28, 1904 (allotment)	5,000	
March 3, 1905	40,000	
		117,500
Total		300,100

COMMERCIAL STATISTICS FOR PORT OF APALACHICOLA, FLA., FROM JULY 1, 1904, TO JUNE 30, 1905.

Exports to foreign ports	$203,347
Exports to coastwise ports	491,250
Total	694,597

	Number.	Tons.
Vessels entered from—		
Foreign ports	47	21,121
Coastwise ports	17	10,375
Total	64	31,496
Vessels cleared for—		
Foreign ports	38	16,989
Coastwise ports	42	20,811
Total	80	37,800
Vessels engaged in traffic of the port:		
Steam	25	1,540
Sail	29	344
Total	54	1,884

Amount of fees, dues, and duties paid during the year, $1,236.87.

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Freight carried.

Articles.	Quantity.	Value.
Lumber.....feet B. M..	30,323,652	$694,597

The figures given above do not include anything shipped or received by vessels which do not enter and clear at the custom-house.

Q 3.

IMPROVEMENT OF APALACHICOLA RIVER, THE CUT-OFF, AND CHIPOLA RIVER, FLORIDA.

(A) APALACHICOLA RIVER, THE CUT-OFF, AND LOWER CHIPOLA RIVER.

Description of this river, statement of project for its improvement, and facts concerning its original and present conditions are given in Annual Report of the Chief of Engineers for 1905, page 313.

A complete synopsis of work done upon the river from January 1, 1875, to June 30, 1895, may be found in Annual Report of the Chief of Engineers for 1896, pages 1348–1350. Work from June 30, 1895, to June 30, 1903, is described in Annual Reports of the Chief of Engineers for 1900, pages 2096–2097; for 1901, pages 1769–1771; for 1903, page 1212, and for 1904, pages 1766–1767.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1905.

The snag boat and dipper dredge belonging to the Chattahoochee River were employed on this improvement during a part of the low-water season, and the following work was done:

Snag boat.

Overhanging trees removed	2,210
Overhanging trees trimmed	83
Snags removed from river	711
Bushes cut (estimated)	5,639
Logs removed from river	36
Logs removed from bank	374
Stumps removed from river	1,033
Stumps on bank cut level	254

At a cost of $2,400.

Dredge.

22,894 cubic yards of sand, mud, and gravel were dredged at a cost of $1,350, or approximately, 6 cents per cubic yard.

The result of this work has been to keep the Apalachicola River free from obstructions and to widen and thus materially improve the channel through the Cut-off and Lee Slough, so that steamers can now use the channel through the Cut-off, Lee Slough, and lower Chipola River upstream as well as on the down trip. No increase in depth has been secured, but Lee Slough and part of the Cut-off have been widened to at least 60 feet.

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RECOMMENDATIONS AND ESTIMATES.

The Apalachicola River requires the removal of the annual accumulation of logs, snags, and overhanging trees and the deepening and maintenance of the channel across the bar at Blountstown. The Cut-off, Lee Slough, and lower Chipola River require the removal of obstructions and dredging, particularly at the sharp bends and narrow places, as it is thought that the slough will eventually become the main river, and as there are no important landings on the old river in this section it would be advisable to aid this change.

The upper Chipola River, now made part of this improvement, requires the removal of snags, logs, overhanging trees, and cypress trees and stumps between Look and Tremble shoal and the foot of the Dead Lakes at the lower Chipola River, and the dredging of a channel through the mud bar at Sister Islands. This work will open up a waterway from the Apalachicola River system to Look and Tremble shoal, about 45 miles below Marianna. To extend the improvement farther would require the construction of at least one lock and dam and very expensive channel work over rock shoals, therefore no further work than above outlined is recommended, as the river has already been cleaned of snags above Look and Tremble shoal, and in high stages barges can bring down freight from Marianna to the shoal and then transfer it.

It is proposed to apply the available funds and the additional appropriations recommended to the maintenance of the improved portions of the system of rivers, to dredging at Blountstown, and in the Cut-Off, Lee Slough, and lower Chipola River, and to the removal of obstructions from the channel of the upper Chipola River through the Dead Lakes.

Money statement.

July 1, 1904, balance unexpended		$3,750.00
Amount appropriated by river and harbor act approved March 3, 1905		12,000.00
		15,750.00
June 30, 1905, amount expended during fiscal year, for maintenance of improvement		3,750.00
July 1, 1905, balance unexpended		12,000.00
Amount (estimated) required for completion of existing project		42,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$10,000.00	
For maintenance of improvement	8,000.00	
		18,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

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APPROPRIATIONS.

May 23, 1828	$3,000	September 19, 1890	$2,000
April 23, 1830	2,000	July 13, 1892	5,000
March 2, 1831	8,000	August 18, 1894	5,000
June 23, 1874	10,000	June 3, 1896	5,000
March 3, 1875	10,000	March 3, 1899	3,000
June 18, 1878	8,000	June 6, 1900 (allotment from emergency act)	1,500
March 3, 1879	5,000	June 13, 1902	6,000
June 14, 1880	2,000	June 13, 1902 (allotment made May 31, 1904)	3,750
March 3, 1881	1,500	March 3, 1905	[a]12,000
August 2, 1882	2,000		
July 5, 1884	1,000		
August 5, 1886	1,000		
August 11, 1888	2,000	Total	98,750

COMMERCIAL STATISTICS.

The commerce on this river is chiefly cotton, naval stores, general merchandise, saw logs, and timber for export. This river runs through a section of country where there are no railroads, and the country bordering upon it depends largely on the steamboats for transportation of products and supplies. There is also a large passenger traffic on the river.

Reference is made to reports on the Flint and upper Chipola rivers for detailed statistics.

(B) UPPER CHIPOLA RIVER, FLORIDA, FROM MARIANNA TO ITS MOUTH.

Description of this river and statements of its past and present conditions and of the project are given in the Annual Report of the Chief of Engineers for 1905, page 314.

The work done is described on pages 2099–2100, Annual Report of the Chief of Engineers for 1900, and on page 1768 for 1904.

No work was done during the fiscal year ending June 30, 1905, and recommendations and estimates will be found in the report of the Apalachicola River, with which this improvement has been combined.

APPROPRIATIONS.

March 3, 1899	$5,000
June 13, 1902	2,000
Total	7,000

COMMERCIAL STATISTICS.

Statement of business done during the past fiscal year on the upper Chipola River and Dead Lakes, Florida, by the Chipola Barge Company.

Name and description.	Registered tonnage.	Draft.		Number of round trips, and between what places.	Passengers.
		Light.	Loaded.		
		Feet.	*Feet.*		
Little Belle (tug and barges)	2	3½	4	52, mouth of Dead Lakes to steel bridge.	.....
Annie M. (tug and barges)	13	8	8	.....do.....	100

[a] Includes $4,000 allotted for upper Chipola River.

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Freight carried.

Articles.		Quantity.	Tons.
Cotton	bales	10	2½
Cotton seed	sacks	50	3
Cotton-seed meal	do	2,000	100
Fertilizers	do	2,500	250
Oats	do	800	80
Corn	do	1,000	85
Hay	bales	2,500	125
Wool	do	5	1
Rosin	barrels	8,000	1,600
Turpentine	do	3,000	600
Flour	do	700	70
Sugar	do	50	8
Molasses	do	50	12
Ties	bundles	1,500	18
General miscellaneous	packages	200	20
Lumber	feet	10,000	20
Provisions (case goods)	packages	1,800	90
Coffee	sacks	25	2
Corn meal	do	1,000	50
Bacon, smoked and dry salted	boxes	120	20
Salt	sacks	120	12
Lard	packages	1,200	30
Soap	boxes	1,000	50
Nails	kegs	125	7
Shingles	number	200,000	200
Brick	do	200,000	500
Total			3,955

Estimated value of above freights (in round numbers)	$218,000
150 rafts of saw logs, valued at	52,500
Total	270,500

Q 4.

IMPROVEMENT OF FLINT RIVER, GEORGIA.

For previous history, statement of project, and present conditions see Annual Report of the Chief of Engineers for 1905, page 316.

For a detailed account of past operations see Annual Reports of the Chief of Engineers for 1900, pages 2102–2103; 1901, pages 1773–1775; 1903, page 1215, and 1904, page 1770.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1905.

Operations during the fiscal year, except for a few days in June, have been confined to the section of river between Albany, Ga., and Newton, Ga., and have resulted in the completion of a channel 60 feet wide and 3 feet deep at low water throughout this section.

In future, work will be confined to the section between Bainbridge, Ga., and Newton, Ga., until a similar channel has been secured in this section.

It is estimated that the project is about one-half completed.

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The actual work done during the year is as follows:

Rock excavation.

Albany shoals	cubic yards	481
Mascot Bend	do	55
Tea Cup shoals	do	259
Ferguson shoals	do	234
Nigger Head shoals	do	1,139
Red Bluff Rapids	do	68
Mingos Island	do	12
Between Tea Cup and Keatons	do	77
Keatons shoals	bowlders	18

At a cost of $5,152.

Snags removed	number	86
Logs removed	do	94

Care and preservation of plant.

At a cost of $655.

RECOMMENDATIONS AND ESTIMATES.

It is recommended that for the present work be confined to the river below Newton, Ga., and include the enlargement of channels through rock reefs and the removal of bowlders between Newton and Bainbridge; the removal of isolated bowlders below Bainbridge, and such snagging operations as may be required for maintenance.

For rapid and economical work a suitable dipper dredge is required in connection with the drilling barge for removing the blasted rock, and as none is available one should be constructed.

It is proposed to expend the funds now on hand in continuing work with the drilling barge between Newton and Bainbridge, and to apply the funds recommended as follows:

Removing bowlders below Bainbridge	$4,000
Construction of dredge	9,000
Channel work between Newton and Bainbridge	15,000
For maintenance, snagging, etc	2,000
Total	30,000

Money statement.

July 1, 1904, balance unexpended		$6,558.66
Amount appropriated by river and harbor act approved March 3, 1905		20,000.00
		26,558.66
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$4,000.00	
For maintenance of improvement	1,269.65	
		5,269.65
July 1, 1905, balance unexpended		21,289.01
July 1, 1905, outstanding liabilities		1,195.47
July 1, 1905, balance available		20,093.54
Amount (estimated) required for completion of existing project		73,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$28,000.00	
For maintenance of improvement	2,000.00	
		30,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

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APPROPRIATIONS.

June 23, 1874	$18,000	August 11, 1888	$20,000
March 3, 1875		September 19, 1890	20,000
August 14, 1876		July 13, 1892	15,000
June 18, 1878	10,000	August 18, 1894	8,000
March 3, 1879	7,000	June 3, 1896	8,000
June 14, 1880	20,000	March 3, 1899	5,000
March 3, 1881	15,000	June 13, 1902	25,000
August 2, 1882	25,000	March 3, 1905	20,000
July 5, 1884	20,000		
August 5, 1886	20,000	Total	256,000

COMMERCIAL STATISTICS.

The commerce of this stream is principally cotton, naval stores, and lumber. There are great quantities of fine timber along the banks of the river, mainly pine, cypress, and hardwood.

When the river is made navigable from Albany to Bainbridge the entire year it will greatly benefit these industries and new ones will spring up along the river.

Statement of business done by steamboats on the Flint River, Georgia, compiled from information furnished by the officers of the Thronateeska Navigation Company and others interested:

Stern-wheel steamboats.	Registered tonnage.	Draft.		Round trips.	Between—
		Light.	Loaded.		
		Inches.	*Inches.*		
John R. Sharpe	50	14	36	285	Newton, Bainbridge, Albany, and Chattahoochee.
Forest	56	18	36	156	Newton and Albany.

Freight carried.

Articles.		Quantity.	Tons.
Cotton	bales	3,500	875
Cotton seed	sacks	2,140	134
Cotton-seed meal	do	3,100	310
Fertilizers	do	3,200	320
Oats	do	2,160	216
Corn	do	2,160	108
Hay	bales	3,100	150
Rosin	barrels	100,500	25,125
Turpentine	do	3,720	744
Flour	do	3,200	320
Sugar	do	1,150	164
Molasses	do	500	125
Bagging	rolls	2,100	52
Ties	bundles	710	18
General miscellaneous	packages	600	60
Hides and skins	do	250	50
Live stock	head	10	8
Lumber	feet	104,000	104
Staves	pieces	150	15
Provisions (case goods)	packages	2,550	255
Coffee	sacks	1,150	96
Corn meal	do	3,100	155
Bacon, smoked and D. S	boxes	2,000	335
Salt	sacks	450	56
Lard	packages	300	7
Soap	boxes	300	20
Nails	kegs	1,200	120
Shingles	number	700,000	350
Brick	do	20,000	500
Total			30,792

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Estimated value of above freight rates (in round numbers), $1,539,600.

Between Bainbridge, Ga., and the mouth of the river the stream is used for the steamers plying the Chattahoochee and Apalachicola rivers, and for the commerce of this entire system reference is made to the following tables:

Stern-wheel steamboats.	Registered tonnage.	Draft.		Round trips.	Between—	Passengers.
		Light.	Loaded.			
		Inches.	*Inches.*			
M. W. Kelly	95	18	54	29	Columbus and Apalachicola	2,630
Queen City	150	24	48	35	do	3,320
W. C. Bradley	175	20	48	17	do	930
J. W. Hires	125	20	48	74	do	5,313
Gertrude	285	30	72	154	Apalachicola and River Junction.	18,110

Freight carried.

Articles.	Quantity.	Tons.
Cotton ..... bales	10,005	2,501
Cotton seed ..... sacks	55,217	3,865
Cotton-seed meal ..... do	10,130	506
Fertilizers ..... do	52,365	5,236
Grain ..... do	18,380	1,840
Rosin ..... barrels	80,280	20,070
Turpentine ..... do	25,840	6,460
Molasses ..... do	6,020	1,505
General miscellaneous ..... packages	188,848	32,237
Hides and skins ..... do	125	6
Live stock ..... head	300	125
Lumber ..... feet	621,000	1,242
Provisions (case goods) ..... packages	168,422	20,097
Shingles ..... number	2,085,000	20,850
Brick ..... do	687,000	1,717
Total		117,757

Estimated value of above freights (in round numbers), $10,657,000.

In addition to the above large quantities of timber are carried down these streams in rafts to sawmills at Apalachicola and Carrabelle, Fla., for which no value is given, as there seems to be no record of the amount of this timber, but its value is included in the general value of the commerce reported for Apalachicola and Carrabelle, Fla.

Q 5.

IMPROVEMENT OF CHATTAHOOCHEE RIVER, GEORGIA AND ALABAMA.

For description and statements of project, see Annual Report of the Chief of Engineers for 1905, page 317. For detailed statements of past operations, see Annual Reports of the Chief of Engineers as follows: 1898, pages 1388–1390; 1900, pages 2107–2108; 1901, pages 1775–1777; 1902, pages 1263–1264; 1903, pages 1218–1219; 1904, pages 1773–1774.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1905.

The jetty system immediately below Columbus was repaired and extended down the river to the Mound, 7 miles below Columbus. Jetties were also started at Jennys Island and Abercrombies bar to maintain the dredged channels. Channels 4 to 5 feet deep and about

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100 feet wide were dredged at the city wharf, Columbus; at Jennys Island, Abercrombies, Woolfolks and just above, Broken Arrow, Indian Mound, Snake shoals, and Chambers Landing. The jetties are of the type described in the last annual report and, in dredging, all material removed has been deposited in the bed of the river, where it is proposed to hold it in place with the jetties.

The following is a detailed statement of the season's work:

Overhanging trees removed	900
Overhanging trees trimmed	48
Logs removed from river	30
Logs removed from bank	27
Stumps on bank cut level	10
Snags removed from river	934

At a cost of $5,038.99.

Dredging 120,134 cubic yards of sand and gravel, at a cost of $11,141.24, or approximately 0.09¼ cents per cubic yard.

Constructing 9,191 linear feet of jetty and repairing 790 feet, at a cost of $25,157.41, or approximately $2.50 per linear foot for new work.

Other expenditures for office and incidentals amounted to $4,079.17.

Two pile-driver barges were built and equipped by hired labor, at a cost of $854.

RECOMMENDATIONS AND ESTIMATES.

In addition to work for which funds have already been provided, the following is of immediate importance and is recommended:

Works of regulation are required at the following places where the river has excessive width, viz: Jennys Island, Mound bar, Abercrombies bar, Woolfolks Bend, Slick bluff, Shell Creek, Gunboat shoals, Francis Bend, and Smiths Bend, and in most of these places these works should be assisted by dredging; rock and marl reefs should be removed at Slick bluff, Rock Island, Kings rock, and other less important points.

The river should be maintained clear of snags and other similar obstructions at all times.

It is proposed to apply the available funds and appropriations recommended to repairing and extending the system of jetties in the Town reach, to repairing and constructing other works of regulation where necessary, to dredging, and to such other work as may be necessary to keep the channel open.

It is proposed to apply the additional funds recommended as follows:

Operating snag boats *Flint* and *Chattahoochee*	$18,000
Operating dipper dredge	9,000
Operating suction dredge	9,000
Operating tow boat	9,000
Repairs to works of contraction	15,000
Building additional works of contraction	75,000
Removing rock and marl reefs (drilling and blasting)	5,000
Repairs and care of plant	10,000
Total	150,000

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Money statement.

July 1, 1904, balance unexpended		$40,720.46
Amount appropriated by river and harbor act approved March 3, 1905		75,000.00
		115,720.46
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$10,000.00	
For maintenance of improvement	35,856.10	
		45,856.10
July 1, 1905, balance unexpended		69,864.36
July 1, 1905, outstanding liabilities		9,259.72
July 1, 1905, balance available		60,604.64
July 1, 1905, amount covered by uncompleted contracts		947.03
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$80,000.00	
For maintenance of improvement	70,000.00	
		150,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

APPROPRIATIONS.

February 24, 1835	$2,000.00	August 18, 1894	[b]$25,000.00
June 23, 1874	[a]52,000.00	June 3, 1896	[b]20,000.00
March 3, 1875		March 3, 1899	[b]45,000.00
August 14, 1876		June 13, 1902	100,000.00
June 18, 1878	18,000.00	Amount of unexpended balance transferred from appropriation for Chattahooche River, between Westpoint and Franklin	280.78
March 3, 1879	15,000.00		
June 4, 1880	20,000.00		
March 3, 1881	20,000.00		
August 2, 1882	25,000.00		
July 5, 1884	35,000.00	April 28, 1904 (allotment made May 31, 1904)	32,650.00
August 5, 1886	20,000.00		
August 11, 1888	20,000.00	March 3, 1905	75,000.00
September 19, 1890	20,000.00		
July 13, 1892	20,000.00	Total	[c]564,930.78

CONTRACTS IN FORCE.

With Hartley Boiler Works, of Montgomery, Ala., dated April 21, 1905 (emergency), for one steel boiler delivered at Columbus, Ga., for $681.50; commenced May 21, 1905; to be completed thirty days thereafter.

With Wm. Beach Hardware Company, of Columbus, Ga., dated April 24, 1905 (emergency), for 2,000 pounds 40 per cent dynamite, at $12.87 per hundred pounds, and 1,000 exploders, at 0.03½ cents each, delivered at Columbus, Ga., in lots of 100 pounds, as may be required, and completed within nine months of date of first delivery.

COMMERCIAL STATISTICS.

The commerce interested on this river is chiefly cotton, naval stores, and general merchandise. The river runs through a section of country where there

[a] Allotted from appropriations aggregating $70,000 for improving Chattahoochee and Flint rivers.

[b] Does not include $5,000 for expenditure between Westpoint and Franklin.

[c] Of this amount $2,000 (appropriation of February 24, 1835) was carried to the surplus fund.

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are but few railroads (none parallel with the river), and the people depend largely on the boats for their supplies. There is also a large passenger traffic on the river.

The commercial statistics for the Chattahoochee River are so combined with those of the Flint and Apalachicola and upper Chipola rivers that a separation is impossible, and reference is made to report upon Flint and upper Chipola river improvements for detailed statistics.

Columbus, Ga., at the head of navigation, with its magnificent water power, is rapidly becoming one of the greatest manufacturing centers of the South, and with the completion of the deep-water harbor projected at the mouth of this system of rivers the importance of this improvement will be greatly increased.

Q 6.

IMPROVEMENT OF CHOCTAWHATCHEE RIVER, FLORIDA AND ALABAMA.

For description, statements of project, and original and present conditions see Annual Report of the Chief of Engineers for 1905, page 319.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1905, BETWEEN NEWTON AND GENEVA, ALA.

On this section work has been confined mainly to preparations for the coming season's operations, which will commence immediately below Newton and be carried downstream. A small barge has been constructed and necessary tools and appliances for excavating a channel through the marl shoals collected. Operations were commenced June 14, 1905, at Newton, Ala., and on June 30, 1905, had been carried 1¼ miles down the river. The work done was as follows:

Marl excavated from channel	cubic yards	129
Snags removed from river		4
Fish traps removed from channel		2

GENERAL IMPROVEMENT.

Work has been confined to the section of the river below the mouth of the Holmes River, no work being done above this point or upon the Cypress Top outlet.

Snagging operations were commenced August 1, 1904, with the snag boat *Escambia* and suspended November 29, 1904, after all obstructions had been removed from the river below the mouth of the Holmes River. Thirty-three miles of river were improved, and the work done was as follows:

Snags removed from river	1,338
Logs removed from river	855
Stumps removed from river	5
Stumps on bank cut level	171
Overhanging trees removed	477
Overhanging trees trimmed	59
Wood cut by party, cords	15½

At a cost of $2,710.02.

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RECOMMENDATIONS AND ESTIMATES.

With funds now available the permanent part of the improvement of the section of the river between Newton and Geneva will be completed, and no further work on it is recommended. As there is no commerce upon this part of the river and none can reasonably be looked for, this section has for years past been reported as unworthy of further improvement. No appropriation is therefore recommended, but if made, as heretofore, it should be small and provide for maintenance only.

Below Geneva the river should be kept clear of all obstructions, to provide proper facilities for the timber industry and the growing commerce on this river and its tributary, the Holmes River. There are now four steamers engaged in this commerce.

The channel across the bar at Cypress Top should be deepened to afford proper facilities for the tugs engaged in the large lumber trade of the river.

The additional funds recommended for appropriation are for the river below Geneva only, and it is proposed to apply them to removing obstructions from Geneva to the mouth and to maintaining and deepening the channel at Cypress Top.

Should Congress make any funds applicable to the section above Geneva, as has been done heretofore, the appropriation recommended for the river should be increased by an amount not exceeding $3,000 for maintenance only.

Money statement.

July 1, 1904, balance unexpended	$3,270.70
Amount appropriated by river and harbor act approved March 3, 1905	10,000.00
	13,270.70
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	3,960.72
July 1, 1905, balance unexpended	9,309.98
July 1, 1905, outstanding liabilities	559.52
July 1, 1905, balance available	8,750.46
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	20,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

March 3, 1833	$5,000.00	August 18, 1894	$6,000.00
June 15, 1844	10,000.00	June 3, 1896	5,000.00
June 25, 1874	5,000.00	March 3, 1899	16,000.00
March 3, 1875	5,000.00	June 13, 1902	16,000.00
August 4, 1876	5,000.00	June 13, 1902 (allotment made May 31, 1904)	3,000.00
March 3, 1879	5,000.00	March 3, 1905	10,000.00
June 14, 1880	7,000.00		
March 3, 1881	10,000.00		
August 2, 1882	[a]18,000.00	Total	191,000.00
July 5, 1884	15,000.00	Carried to the surplus fund, 1852	2,123.38
August 5, 1886	15,000.00		
August 11, 1888	10,000.00		
September 19, 1890	12,500.00	Balance	188,876.62
July 13, 1892	12,500.00		

[a] Does not include $2,000 allotted for expenditure on Holmes River.

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COMMERCIAL STATISTICS.

The commerce of this stream is mainly saw logs, timber, naval stores, and general merchandise, the value of which for the fiscal year ending June 30, 1905, is estimated at $1,500,000.

Q 7.

IMPROVEMENT OF HOLMES RIVER, FLORIDA, FROM VERNON TO ITS MOUTH.

For descriptive statement of conditions and project, see Annual Report of the Chief of Engineers for 1905, page 320.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1905.

With the snag boat *Choctawhatchee* the river was cleared of obstructions from Vernon to its mouth, operations being carried on from August 25, 1904, to November 30, 1904. The work done was as follows:

Length of river worked over, miles	25
Snags removed from river	824
Logs removed from river	259
Logs removed from bank	263
Overhanging trees removed from river	4,712
Overhanging trees trimmed	1,621
Stumps removed from river	16
Bushes cut (estimated)	2,760
Wood cut, cords	12

At a cost of $2,029.29.

During June, 1905, work was commenced upon the improvement of Boyntons bar by works of contraction, and 150 feet of pile and brush jetties were partially constructed. The cost of this work, including repairs to plant and transfer to the improvement, was $439.53.

RECOMMENDATIONS AND ESTIMATES.

As a large and growing commerce has sprung up on this stream between Vernon and Pensacola, it should be cleared of obstructions and maintained in this condition. The funds recommended are to be applied to this work.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1905	$2,000.00
Amount allotted from appropriation for maintenance of river and harbor improvements, act of April 28, 1904	2,000.00
	4,000.00
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	2,468.82
July 1, 1905, balance unexpended	1,531.18
July 1, 1905, outstanding liabilities	664.02
July 1, 1905, balance available	867.16
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	3,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

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APPROPRIATIONS.

August 2, 1882	[a]$2,000	April 28, 1904 (allotment)	$2,000
August 5, 1886	2,000	March 3, 1905	2,000
August 11, 1888	3,000		
September 19, 1890	3,000	Total	[b]14,000

COMMERCIAL STATISTICS.

The commerce of this stream consists of cotton, turpentine, rosin, molasses, honey, and miscellaneous articles, which are carried by water to Pensacola to market, four steamers being engaged in the trade, the value of which in 1905 is estimated at $500,000.

Q 8.

IMPROVEMENT OF BLACKWATER RIVER, FLORIDA.

A description of the locality, its original condition, the project for improvement, the recommendations resulting from recent examinations, and the present condition of the channel are stated in the Annual Report of the Chief of Engineers for 1904, pages 1792–1797.

Work done prior to June 30, 1900, will be found described on pages 2127–2128, Annual Report of the Chief of Engineers for 1900.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1905.

Nothing was done during the fiscal year.

RECOMMENDATIONS AND ESTIMATES.

The channel should be completed from Milton to Pensacola Bay as projected and then maintained. It is proposed to apply the funds available and the appropriation recommended to this work.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1905		$10,000.00
July 1, 1905, balance unexpended		10,000.00
Amount (estimated) required for completion of existing project		5,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$5,000.00	
For maintenance of improvement	5,000.00	
		10,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

[a] Allotted from appropriation of $20,000 for improving Choctawhatchee River.

[b] Of this amount there was returned to the Treasury $4,839.20, which was reappropriated by act of March 3, 1899.

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APPROPRIATIONS.

March 3, 1899	$5,000
March 3, 1905	10,000
Total	15,000

COMMERCIAL STATISTICS.

The value of timber and lumber going out of this river amounts to from $700,000 to $800,000 annually, and the manufactured product of the sash factory at Bagdad is from $25,000 to $35,000. In addition to this there are wool and other products shipped from Milton amounting to from $35,000 to $50,000. There is a dry dock at Bagdad and a marine railway at Milton, to which nearly all of the steamboats and sailing vessels owned at Pensacola come, and more would come if there was sufficient water.

Q 9.

IMPROVEMENT OF PENSACOLA HARBOR, FLORIDA.

For description of original condition of the improvement, project, and work done see Annual Report of the Chief of Engineers for 1905, page 321.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1905.

At the beginning of the year the Caucus channel had shoaled to a minimum low-water depth of 26.5 feet and an estimated width of 100 feet. As immediate relief was required to prevent serious interference with the commerce of Pensacola, arrangements were made to obtain the U. S. dredge *Winyah Bay* from the Charleston district to do the work most urgently needed. The dredge left the Charleston district August 1, 1904, commenced work on August 10, 1904, and suspended work on February 14, 1905, and reported back to the Charleston district. During this period she worked 115 days; was delayed by repairs 9 days; by weather, 27 days; by coaling, cleaning boilers, etc., 12 days; spent 20 days en route to and from Pensacola, and rental at the rate of $35 per day was therefore paid for 162 days. She removed 200,108 cubic yards of material, at a cost of $0.0978 per yard, and restored Caucus channel to a depth of 30 feet for a width of 150 feet. On June 30, 1905, the channel was still in excellent condition, being 30 feet at mean low water, except between buoys No. 1 and No. ½ at the outer end, where the last work was done, and the loosened material has apparently formed a short shoal with only 29.2 feet over it. No further work will be required until the dredge *Caucus*, building for this improvement, is available for work.

Examinations of Caucus channel were made from time to time to determine its condition, and the property belonging to the improvement was cared for.

RECOMMENDATIONS.

The new dredge *Caucus* should be kept at work continuously until the project has been completed.

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It is proposed to apply the available funds and the appropriations recommended to the operation of the new dredge *Caucus*, including the purchase of the necessary spare parts, etc.

Money statement.

July 1, 1904, balance unexpended		$67,846.38
Amount appropriated by river and harbor act approved March 3, 1905		100,000.00
		167,846.38
Amount allotted from appropriation for maintenance of river and harbor improvements, less amount allotted for dredge construction		26,000.00
		141,846.38
June 30, 1905, amount expended during fiscal year, for maintenance of improvement		25,610.79
July 1, 1905, balance unexpended		116,235.59
July 1, 1905, outstanding liabilities		5,334.55
July 1, 1905, balance available		110,901.04
Amount (estimated) required for completion of existing project		250,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$60,000.00	
For maintenance of improvement	10,000.00	
		70,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

APPROPRIATIONS.

June 18, 1878	$20,000.00	August 18, 1894	$100,000.00
March 3, 1879	10,000.00	June 3, 1896	200,000.00
June 14, 1880	40,000.00	March 3, 1899	70,000.00
March 3, 1881	20,000.00	June 6, 1900 (allotment)	5,000.00
August 2, 1882	50,000.00	June 13, 1902	[a]220,000.00
July 5, 1884	55,000.00	August 18, 1902 (allotment)	956.94
August 5, 1886	20,000.00	March 3, 1905	100,000.00
August 11, 1888	35,000.00		
September 19, 1890	25,000.00		
July 13, 1892	75,000.00	Total	1,045,956.94

COMMERCIAL STATISTICS.

The following information has been received from the collector of customs, port of Pensacola, Fla.:

Exports to foreign ports	$15,295,067
Exports to coastwise ports (no record).	
Imports from foreign ports	985,840
Duties on imports	9,611
Total	995,451

[a] Includes $150,000 appropriated for construction of seagoing dredge and $26,000 allotted by the Chief of Engineers for same purpose.

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	Number.	Tons.
Vessels entered from—		
Foreign ports	263	400,799
Coastwise ports	124	202,665
Total	387	603,444
Vessels cleared for—		
Foreign ports	325	518,679
Coastwise ports	71	84,867
Total	396	603,546
Vessels employed in traffic of port:		
Steam	38	2,823
Sail	110	3,489
Total	148	6,312

Amount of fees, dues, and duties paid during the year, $21,782.38.

Freight carried.

Articles.	Quantity.	Value.
Cotton ..... bales	107,945	$3,602,659
Lumber ..... feet B. M.	151,190,000	2,360,765
Coal ..... tons	210,083	511,536
Rosin ..... barrels	182,205	599,165
Spirits ..... gallons	412,450	231,300
Miscellaneous	.....	2,989,644
Total	.....	15,295,069

Q 10.

IMPROVEMENT OF ESCAMBIA AND CONECUH RIVERS, FLORIDA.

For description of this waterway and statements of condition and project, see Annual Report of the Chief of Engineers for 1905, page 323.

The object of the improvement is to keep open a channel suitable for the safe passage of rafts and logs during low stages of the river, and to enable tugs to cross the bar at the river's mouth to handle the raft timber. This object has been accomplished once, but the improvement has since deteriorated greatly.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1905.

Due to lack of funds, work has been principally confined to care and preservation of plant, the snag boat belonging to this improvement being employed on the Choctawhatchee and Holmes rivers during the greater part of the year.

During the latter part of the year the snag boat *Escambia* was taken to Pine Barren, Fla., thoroughly overhauled, including machinery and interior painting, and on April 4, 1905, snagging operations were resumed. Work was commenced at Pine Barren and carried upstream, and the following was accomplished:

Overhanging trees removed		22
Stumps on bank cut level		2
Snags removed from river		197
Logs removed from river		14
River worked over	miles	9
Wood cut	cords	4

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RECOMMENDATIONS AND ESTIMATES.

The bar at the mouth of the river should be redredged to permit the entrance of tugs to secure the rafts, which they tow to Pensacola, as these rafts now have to be floated out over the bar, involving serious delays and losses. The river should also be kept in good condition for rafting, as the output of this river forms a large part of the lumber trade of Pensacola. This work will require the continuous operation of the snag boat and dredge.

It is proposed to apply the funds on hand and the additional appropriations recommended to operating the snag boat and to dredging the channel over bar.

Money statement.

July 1, 1904, balance unexpended	$759.30
Amount appropriated by river and harbor act approved March 3, 1905	10,000.00
	10,759.30
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	1,643.81
July 1, 1905, balance unexpended	9,115.49
July 1, 1905, outstanding liabilities	812.00
July 1, 1905, balance available	8,303.49
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	20,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

For Escambia River:		
March 2, 1833	$5,000	
July 2, 1836	5,500	
June 14, 1880	8,000	
March 3, 1881	5,000	
July 5, 1884	3,000	
		$26,500
For Escambia and Conecuh rivers:		
August 2, 1882	12,000	
July 5, 1884	12,000	
August 5, 1886	12,000	
August 11, 1888	10,000	
September 19, 1890	7,500	
July 13, 1892	8,000	
August 18, 1894	6,000	
June 3, 1896	4,000	
March 3, 1899	5,000	
June 6, 1890 (allotted from emergency act)	1,500	
June 13, 1902	5,000	
March 3, 1905	10,000	
		93,000
		119,500
Carried to the surplus fund, 1838		5,500
Balance		114,000

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COMMERCIAL STATISTICS.

The commerce of this stream is mainly timber, lumber, and saw logs. It is reported as being valued at $1,800,000 for the fiscal year.

Q 11.

IMPROVEMENT OF ALABAMA RIVER, ALABAMA.

For description, statements of past and present conditions, and projects see Annual Report of the Chief of Engineers for 1905, page 324. Previous operations upon this river will be found in Annual Reports of the Chief of Engineers as follows: 1896, pages 1397 et seq.; 1898, pages 1406 et seq.; 1899, pages 1677 et seq.; 1900, pages 2133 et seq.; 1901, pages 1786 et seq.; 1902, pages 1272–1273; 1903, page 1228, and 1904, pages 1782–1785.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1905.

The snag boat *Wm. J. Twining* was employed throughout the working season removing obstructions from the river. Due to the extreme low water prevailing in the fall of 1904 the snag boat was unable to work for a large part of the low-water season and operations were principally confined to the lower part of the river. The following work was done:

Overhanging trees removed	647
Overhanging trees trimmed	4
Logs on bank cut up	10
Stumps removed from river	47
Snags removed from river	297
Trees removed from river	32
Deadheads removed from river	19

At a cost of $3,452.26.

During the month of May, 1905, the snag boat *Twining* was taken to Mobile, Ala., for repairs necessary to put her in good condition, and at the close of the fiscal year these repairs were 75 per cent completed.

The machinery on the dipper dredge was thoroughly overhauled and necessary repairs and additions made to hull and machinery to put her in first-class condition. Upon completion of these repairs she was put to work at lower Gause's bar to thoroughly test her machinery, and at the end of the fiscal year had dredged one cut about 300 feet long and 30 feet wide through the gravel bar at that point. Her machinery has worked satisfactorily, and it is estimated that she has removed 2,640 cubic yards of material, at a cost of $0.107 per cubic yard.

The towboat *John Mills*, which had been loaned temporarily for work on the Warrior River, was returned to the Montgomery district during the latter part of June, 1905, but extensive repairs are needed to put her in serviceable condition for the coming season's work.

An attempt was made to raise the two barges sunk in the lock pit at Wetumka in 1897 for storage, but they were found to be entirely rotten, one of them breaking in two on reaching the surface of the water.

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No works of regulation were built or repaired during the year, but funds having recently been made available for this work contracts have been entered into for the construction of the necessary plant.

RECOMMENDATIONS AND ESTIMATES.

Snagging operations should be continued. Channels should be dredged across those shoals which obstruct navigation, and these channels should be secured by works of regulation. Those old works of regulation found to be properly located should be repaired or rebuilt, as may be required. As far as practicable, work should be carried on from the mouth of the river upstream. The most troublesome obstructions at present are Mrs. Gray's bar, Silver Creek shoals, Haines Island, Steins Island, Wilcox bar, Hobbs Island, Evans lower bar, McGuire's bar, Mary Taylor's bar, first bar above Selma, Gardners Island, lower Gause's bar, and upper Gause's bar.

It is proposed to apply the funds available to the operation of the snag boat *Wm. J. Twining* and the dipper dredge to the construction of plant now under contract, and the construction and repair of works of regulation; and to apply the appropriations recommended to the construction of a suitable hydraulic dredge and the further prosecution of work along the lines above indicated.

Money statement.

July 1, 1904, balance unexpended	$8,447.33
Amount appropriated by river and harbor act approved March 3, 1905	100,000.00
	108,447.33
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	8,847.43
July 1, 1905, balance unexpended	99,599.90
July 1, 1905, outstanding liabilities	16,032.71
July 1, 1905, balance available	83,567.19
July 1, 1905, amount covered by uncompleted contracts	13,777.69
Amount (estimated) required for completion of existing project	176,251.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:	
For works of improvement	$75,000.00
For maintenance of improvement	75,000.00
	150,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

June 18, 1878	$25,000	August 18, 1894	$50,000
March 3, 1879	30,000	June 3, 1896	40,000
June 14, 1880	25,000	March 3, 1899	50,000
March 3, 1881	20,000	June 13, 1902	20,000
August 2, 1882	20,000	June 13, 1902 (allotment made June 21, 1904)	4,000
July 5, 1884	10,000	March 3, 1905	100,000
August 5, 1886	15,000		
August 11, 1888	20,000	Total	519,000
September 19, 1890	20,000		
July 13, 1892	70,000		

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CONTRACTS IN FORCE.

With Robert Middleton, Mobile, Ala., dated May 18, 1905 (emergency), for making certain repairs to U. S. snag boat *Wm. J. Twining;* work, commenced May 31, 1905, to be completed in four weeks thereafter; consideration estimated at $3,445.51.

With Robert Middleton, Mobile, Ala., dated June 12, 1905 (emergency), for construction of two quarter boats, at $1,437.14 each, and one pile-driver barge for $675.90; commenced June 22, 1905, and to be completed in ninety days thereafter.

With James M. Campbell, Mobile, Ala., dated June 13, 1905 (emergency), for construction of four barges, at $1,705 each; commenced June 23, 1905, and to be completed within one hundred days thereafter.

COMMERCIAL STATISTICS.

Statement of business done by steamboats plying the Alabama River, Alabama, compiled from information furnished by owners of same:

Stern-wheel steamboats.	Registered tonnage.	Draft.		Round trips made and between what places.	Passengers.
		Light.	Loaded.		
		Inches.	*Feet.*		
Nettie Quill	299	30	6	40, Mobile and Montgomery	4,057
City of Mobile	209	22	5	44, Mobile and Montgomery	2,608
Ouachita	98	20	4	40, Mobile and Selma	1,300
Mary	198	30	6	Laid up	
Hard Cash	248	22	5		
Six barges	920	10	3		

Freight carried.

Articles.		Quantity.	Tons.
Cotton	bales	39,375	9,844
Cotton seed	sacks	162,841	10,177
Cotton-seed meal	do	69,264	3,463
Fertilizers	do	136,824	13,683
Oats	do	79,340	6,612
Corn	do	77,028	6,419
Hay	bales	36,913	3,076
Wool	do	1,094	274
Rosin	barrels	34,448	8,612
Turpentine	do	22,917	4,584
Flour	do	71,154	7,115
Sugar	do	13,420	2,684
Molasses	do	7,919	1,980
Bagging	rolls	74,920	7,492
Ties	bundles	86,496	2,340
General miscellaneous	packages	49,757	4,976
Hides and skins	do	485	97
Live stock	head	6,344	1,270
Lumber	feet B. M.	967,710	2,420
Staves	pieces	94,296	942
Provisions (case goods)	packages	63,592	6,359
Coffee	sacks	8,132	680
Corn meal	do	72,425	4,032
Bacon, smoked and dry salted	boxes	24,587	4,089
Salt	sacks	28,752	2,875
Lard	packages	30,940	6,188
Soap	boxes	32,660	1,940
Nails	kegs	11,355	677
Shingles	number	1,784,120	1,784
Brick	do	226,500	566
Total			127,250

Estimated value of above freight (in round numbers) $8,907,500
Estimated value of hewn, sawn, and round timber 4,000,000

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The total commerce of the year was less than during the previous year, due to the exceedingly low water and general unfavorable condition of the river.

Very large quantities of sawn and hewn timber, saw logs, cord wood, etc., consisting of yellow pine, sycamore, cottonwood, poplar, and ash, are barged and rafted down this stream to Mobile, Ala., but the amount of this business can not be accurately stated, as the statistics of the port of Mobile combine the receipts from this stream with those of the Tombigbee and other streams tributary to that port.

Q 12.

IMPROVEMENT OF COOSA, OOSTENAULA, AND COOSAWATTEE RIVERS, GEORGIA AND ALABAMA.

For description of these rivers and statements of past and present conditions and project, see Annual Report of the Chief of Engineers for 1905, page 326.

Report on the survey of the Coosa River, required by the river and harbor act of June 13, 1902, which was completed during the last fiscal year and submitted to the Chief of Engineers on June 30, 1904, is published as House Document No. 219, Fifty-eighth Congress, third session, together with supplemental report dated November 22, 1904.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1905.

(A) COOSA RIVER, BETWEEN ROME AND THE EAST TENNESSEE, VIRGINIA AND GEORGIA RAILROAD BRIDGE.

Operations during the year have been confined to maintenance of that part of the improvement between Rome, Ga., and Gadsden, Ala. The dredge was operated throughout the season and kept the channel open for a distance of 90 miles below Rome, Ga., and the necessary works of contraction to maintain the channel were constructed and repaired at all obstructions over 80 miles of this distance.

About 35,820 cubic yards of sand, gravel, and slate were dredged, at a cost of $2,410, or an average of 7 cents per cubic yard. This small cost is due to the fact that the material was deposited in the river alongside the cuts.

About 3,210 linear feet of jetty was built or repaired, at a cost of $6,377, or an average cost of $2.15 per foot.

The plant and other property belonging to the improvement were cared for, and at the end of the fiscal year the plant was overhauled and repaired in readiness for the coming season's work.

The location and details of the year's work are as follows:

	Jetty constructed.	Dredging.
	Linear ft.	*Cubic yds.*
Shorters lower bar	160	
Bluff Road bar[a]	1,000	
Mayos bar	480	
Livingston bar	200	
Cathays bar		12,480
Coperas Bluff	580	6,960
Wrights Island	50	(b)
Mill shoals	420	10,500
Westers bar	320	
Fish trap		2,880

[a] A channel was also made across this bar with a rake.
[b] About 3,000.

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RECOMMENDATIONS AND ESTIMATES.

It is recommended that a channel for 4-foot navigation be secured and maintained between Rome, Ga., and Lock 4, Alabama; that Lock and Dam 4 be completed with necessary modifications to provide for a subsequent increase in lift of 3 feet should the improvement of the Coosa and Alabama rivers for a 6-foot navigation be undertaken at any time and the elevation of Dam 4 be required.

This work will extend steamboat navigation to the railroad at Riverside, Ala., during the greater part of the year, and enable rafts to pass Dam 4 at all times without risk of injury to the dam, such as frequently happens at present. Pending the completion of the lock the raftsmen have been required to conduct operations so as to protect the dam from injury as far as possible. During the higher stages of the river they run their logs over the dam, maintaining a rollway for its protection, but at ordinary stages they are forced to use a derrick and engine to hoist their logs over the dam. If Lock 4 is not constructed soon some proper provision should be made for logs to pass the dam, otherwise well-grounded complaint can be lodged against the dam as obstructing navigation unnecessarily. As the old cofferdam, now serving as the east abutment for the dam, is in bad condition, the lock should be constructed at once to preserve the dam.

The estimate for the work recommended is as follows:

Continuing channel work between Rome, Ga., and Lock 4	$50,000
Completing Lock and Dam 4	263,500
Total	313,500

It is proposed to apply the available funds to improving the channel between Rome, Ga., and Lock 4, as provided in the act of March 3, 1905, and to apply the additional amount recommended to the further improvement and maintenance of the channel between Rome, Ga., and Lock 4 and to completing Lock and Dam 4.

Money statement.

July 1, 1904, balance unexpended		$14,275.87
Amount appropriated by river and harbor act approved March 3, 1905		25,000.00
Unexpended balance July 1, 1904, Oostenaula and Coosawattee rivers, Georgia		2,844.20
		42,120.07
June 30, 1905, amount expended during fiscal year, for maintenance of improvement		14,453.91
July 1, 1905, balance unexpended		27,666.16
July 1, 1905, outstanding liabilities		3,048.87
July 1, 1905, balance available		24,617.29
Amount (estimated) required for completion of existing project		1,143,523.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$288,500.00	
For maintenance of improvement	25,000.00	
		313,500.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

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APPROPRIATIONS.

August 14, 1878	$30,000.00	Received from sales of property	$1,448.05
June 18, 1877	75,000.00	June 13, 1902 (allotment made May 31, 1904)	7,500.00
March 3, 1879	45,000.00	March 3, 1905	25,000.00
July 14, 1880	75,000.00		1,062,648.05
March 5, 1881	60,000.00	Less amount transferred by act of June 13, 1902, to the Oostenaula and Coosawattee rivers	7,155.80
August 2, 1882	83,700.00		
July 5, 1884	50,000.00	Total	1,055,492.25
August 5, 1886	45,000.00		
August 11, 1888	60,000.00		
September 19, 1890	150,000.00		
July 13, 1892	130,000.00		
August 18, 1894	110,000.00		
June 3, 1896	50,000.00		
March 3, 1899	20,000.00		
June 13, 1902	35,000.00		
June 13, 1902, amount made available from lower division of the river	10,000.00		

COMMERCIAL STATISTICS FOR THE FISCAL YEAR ENDING JUNE 30, 1905.

[Furnished by the Georgia and Alabama Steamboat Company, of Rome, Ga.; Coosa River Transportation Company, Gadsden, Ala.; Coosawattee, Oostenaula and Coosa River Packet Company, Rome, Ga.; and the Lathrop-Hatten Lumber Company, Riverside, Ala.]

Stern-wheel steamboats.	Registered tonnage.	Draft. Light.	Draft. Loaded.	Round trips and between what places.	Passengers.
		Inches.	*Feet.*		
Willie C. Wagnon	151	18	4	50, Rome, Ga., and Lock 4	2,375
Connasauga	81	17	3	23, Rome, Ga., and Gadsden, Ala.	
Alabama	137	18	4	55, Rome, Ga., and Lock 3	1,675
Dixie	72	14	4	50, Rome, Ga., and Lock 4	400

Freight carried.

Articles.	Quantity.	Tons.
Cotton, bales	14,502	3,625
Cotton seed, sacks	48,677	3,744
Cotton-seed meal, do	10,300	2,180
Fertilizers, do	43,600	4,360
Oats, do	2,730	273
Corn, do	17,400	1,450
Hay, bales	12,000	600
Saw logs, feet	7,664,130	38,320
Flour, barrels	15,675	1,567
Sugar, do	2,880	360
Molasses, do	366	92
Bagging, rolls	3,820	96
Ties, bundles	6,710	840
General miscellaneous, packages	48,250	4,825
Hides and skins, do	230	46
Live stock, head	212	106
Lumber, feet B. M.	15,850,000	15,850
Staves, pieces	34,000	340
Provisions (case goods), packages	8,180	414
Coffee, sacks	1,070	90
Corn meal, do	20,800	1,040
Bacon, smoked and dry salted, boxes	2,120	360
Salt, sacks	4,300	430
Lard, packages	5,121	103
Soap, boxes	10,741	537
Nails, kegs	7,980	398
Shingles, number	140,000	1,400
Brick, do	450,000	11,250
Total		94,694

Estimated value of above freights (in round numbers), $3,119,200.

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(B) COOSA RIVER BETWEEN WETUMKA AND EAST TENNESSEE, VIRGINIA AND GEORGIA RAILROAD BRIDGE.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1905.

The property belonging to the improvement was properly cared for and such slight repairs were made to the lock house, fences, cement warehouse, and general storage sheds as were found necessary and funds available permitted.

RECOMMENDATIONS AND ESTIMATES.

The buildings at Lock 31 need repairs and painting very badly, and the property stored in them should be cared for. There will be required for these purposes $2,000, in addition to funds already available. At present no other work is recommended pending a decision as to the character and extent of the further improvement of the Coosa River. Should a new project for securing 6-foot navigation in the Coosa and Alabama rivers be adopted, funds should be made available for examination of lock sites, borings for foundations, discharge measurements, gauge observations, and other necessary work preliminary to actual construction.

It is proposed to apply the funds available and the additional funds recommended to the care and preservation of property at Lock 31.

Money statement.

July 1, 1904, balance unexpended	$1,670.40
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	1,213.23
July 1, 1905, balance unexpended	457.17
July 1, 1905, outstanding liabilities	118.42
July 1, 1905, balance available	338.75
Amount (estimated) required for completion of existing project	4,916,390.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	2,000.00

APPROPRIATIONS.

September 19, 1890	$150,000.00
July 13, 1892	100,000.00
August 18, 1894	110,000.00
June 3, 1896	50,000.00
Amount received from sale of Government property	423.32
	410,423.32
Less amount transferred by act of June 13, 1902, to upper division of the river	10,000.00
Total	400,423.32

COMMERCIAL STATISTICS.

On this part of the Coosa there is a small commerce in the rafting of saw logs and square timber, but this can be carried on only during the season when the river is about 12 feet above low water, and no reliable estimate of its value can be obtained.

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(c) OOSTENAULA AND COOSAWATTEE RIVERS.

For description, statements of past and present conditions, and project, see Annual Report of the Chief of Engineers for 1905, page 328.

Description of previous operations upon these rivers will be found in Annual Reports of the Chief of Engineers, as follows: 1872, page 507; 1874, page 581; 1875, page 792; 1876, page 714; 1879, page 1271 et seq.; 1880, pages 1692–1693; 1881, pages 1873–1874.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1905.

Nothing was done during the fiscal year, and as the balance of funds applicable to these streams was too small to put a working party in the field and could be employed to better advantage on the Coosa River between Rome, Ga., and Lock 4, it was transferred to this section of the river.

As the commercial benefits to be derived from the improvement of these rivers are very small and any further improvement of doubtful value, no further appropriations are recommended at present. Should any future appropriations be made, they should provide for the construction and operation of a suitable plant, consisting of one small light-draft snag boat and two light-draft barges, which could be utilized on the upper Coosa River also, for no suitable plant can be hired and rentals for plant obtainable are exorbitant.

Estimate for this plant and operation for one year is as follows:

Construction of light-draft snag boat	$8,000
Construction of two barges	3,000
Operation of plant	9,000
Total	20,000

APPROPRIATIONS.

1874	[a] $10,000.00
1875	5,000.00
1878	4,000.00
1879	3,000.00
1880	2,000.00
1881	1,000.00
1882	1,000.00
Transferred by act of June 13, 1902, from Coosa, Oostenaula, and Coosawattee rivers (Rome division)	7,155.80
Total	[b] 33,155.80

Q 13.

OPERATION AND CARE OF CANALS AND OTHER WORKS OF NAVIGATION ON COOSA RIVER, GEORGIA AND ALABAMA.

During the fiscal year ending June 30, 1905, the locks were operated continuously, except during the repairs to gate valves at Lock 1 and the renewal of the upper gates at Lock 2.

[a] Oostenaula River.

[b] In 1897, $499.39 was covered into the surplus fund.

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An allotment of $10,200 was made for the fiscal year ending June 30, 1905, for the following purposes:

Salaries of lock keepers	$1,800
Dredging entrances to Locks 1, 2, and 3	1,500
Renewing fences around reservations 1, 2, and 3	700
Repairs to filling and emptying valves, Locks 1 and 2	1,000
Repairs to breaks in Dams 1 and 2	3,500
Renewing upper gates, Lock 2	1,000
Renewing upper guide pier, Lock 2	500
Repairs to lock house, Lock 2	50
Repairs to outbuildings, Lock 3	150
Total	10,200

At Lock 1 the dam was repaired and the valves in lower gates repaired. At Lock 2 the gate valves were repaired, the upper gates renewed, the upper guide pier was repaired, and minor repairs made to lock house. At Lock 3 some minor repairs were made to dam. Dredging was done at the entrances to Locks 1, 2, and 3, and the fences renewed around all their reservations.

Summary of expenditures made during the fiscal year ending June 30, 1905, at Locks 1, 2, 3, and 4.

Services	$6,881.80
Material and supplies	888.75
Telegram and expressage	2.01
Provisions	247.63
Fuel	205.82
Travel expenses	74.32
Rent office at Montgomery, register fees, etc	142.24
Total	8,442.57

Q 14.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

The schooner *Grace Andrews* and the tug *Bishop*, sunk near the mouth of Carrabelle River, Florida, having been reported as obstructions to navigation, and an allotment for their removal having been made June 8, 1904, from the indefinite appropriation made by the river and harbor act of March 3, 1899, they were advertised as obstructions to navigation and removed under contract entered into with George Randolph November 7, 1904.

Q 15.

COOSA AND ALABAMA RIVERS, GEORGIA AND ALABAMA.

[Printed in House Doc. No. 219, Fifty-eighth Congress, third session.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, January 9, 1905.

SIR: The river and harbor act approved June 13, 1902, contains the following provision:

Improving Coosa River, Georgia and Alabama, * * * And the Secretary of War shall cause a survey to be made of the Coosa and Alabama rivers with a view to determining the advisability of securing six-foot navigation in said rivers, and the

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probable expense thereof; the said survey shall also contain a report upon the advisability of further prosecuting the present project for locks and dams in the Coosa River. * * *

The survey ordered in the above-quoted item has been made under the direction of Capt. J. B. Cavanaugh, Corps of Engineers, and I have the honor to submit herewith for transmission to Congress his report[a] thereon, dated June 30, 1904, together with his subsequent report[b] of November 22, 1904, and the report[c] of the Board of Engineers for Rivers and Harbors, dated January 4, 1905.

The present project for the improvement of the Coosa River provides for a 4-foot navigation between Rome, Ga., and Wetumka, by slack-water improvement, involving the construction of one lock and dam between Rome, Ga., and Greensport, Ala., a distance of 162 miles; 8 locks and dams between Greensport and the East Tennessee, Virginia and Georgia Railroad bridge, a distance of 74 miles; and of 23 locks and dams from the bridge to Wetumka, a distance of 68 miles. This project has been carried out to the extent of the construction of Locks and Dams Nos. 1, 2, and 3, below Greensport; Lock and Dam No. 4 is under construction; and Lock No. 31, near Wetumka, has been partially built, and some channel work has been done in addition. The amount estimated to complete this project is over $6,000,000.

Considering first the second matter upon which a report is called for, it is the opinion of the local officer and the division engineer that the further prosecuting of the present project for locks and dams in the Coosa River should not be undertaken by the Government beyond the completion of Lock and Dam No. 4, and the construction of a fixed dam, without a lock, at site No. 5. The Board of Engineers for Rivers and Harbors recommends that work under the present project should be restricted to completion of Dam No. 4 without completing the lock. The completion of work at Dam No. 4, without a lock, is estimated by the officer in local charge to cost $108,500.

Considering the first question upon which a report is required, that is, the securing of a 6-foot navigation on the Coosa and Alabama rivers, Captain Cavanaugh draws the conclusion that a 6-foot navigation can be secured from Gadsden, Ala., on the Coosa, to the mouth of the Alabama, at a total cost of $10,024,706 for the river above Wetumka, and $1,000,000 from Wetumka to the mouth, provided the appropriations made for the improvement are sufficiently liberal to permit the work to be carried on economically and advantageously so as to complete it within ten years. The local officer, however, indicates in a subsequent report of November 22, 1904, that the cost of work below Wetumka would be materially greater than $1,000,000, if, indeed, improvement for open-river navigation be practicable over the entire portion of this stretch. The annual maintenance charge, he estimates, would be $100,000 above Wetumka and $55,000 below. From a discussion of the estimated cost of carrying freight by the waterway and the present actual cost of the same transportation by rail Captain Cavanaugh estimates that the saving would be sufficient to warrant undertaking the improvement which he proposes.

The division engineer, Lieut. Col. H. M. Adams, Corps of Engineers, in his indorsement upon Captain Cavanaugh's report, concludes as follows:

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[a] See p. 1354. [b] See p. 1381. [c] See p. 1386.

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The facts presented do not justify the expenditure of anything like the sums mentioned, and I do not consider the improvement of the Coosa and Alabama rivers to secure 6-foot navigation as one worthy of being undertaken by the General Government at the present time.

I concur in the opinion of Captain Cavanaugh that it is not advisable to further prosecute the present project for locks and dams in the Coosa River further than to complete Lock No. 4 and to construct a dam at lock site No. 5, a short distance below Riverside, Ala.

The Board of Engineers for Rivers and Harbors also expresses the opinion that the project of securing 6-foot navigation on the Coosa and Alabama rivers is not worthy of being undertaken by the General Government at this time.

In a supplemental report submitted by Captain Cavanaugh, November 22, 1904, he submits the facts that subsequent to the presentation of his former report, discharge measurements taken during the past season show a low-water discharge much less than has been heretofore considered, and that the low-water improvement of the Alabama River which would result from the work covered by his estimates would fall short of that stated in his former report, and that without further data it is impracticable to predict the extent to which the Alabama can be improved without resort to slack-water navigation. He recommends, in lieu of his former recommendation, an improvement of the Alabama River from Montgomery to the mouth of the river, according to the methods previously considered and along the lines of those which will be required for the maximum possible improvement of the river for open-water navigation, with a view to extending to Montgomery and territory between Montgomery and the mouth of the river such benefits as he believes the local commerce will justify. He presents an estimate of $650,000 for such work, the expenditure of which he thinks will give a 6-foot navigation for at least nine months of the year and afford ample facilities for the local commerce of the Alabama all the year round. He estimates that if such plan were carried out an appropriation of $125,000 should be made available for the year 1906, and that if the work were authorized by continuing contract there would be required $150,000 for the second year and $75,000 a year for the next five years. Maintenance thereafter would cost $50,000 per annum.

The Board of Engineers for Rivers and Harbors, in considering this supplemental report, gives as its opinion that, in view of the experience already had in snagging and works of regulation, a 6-foot navigation can not be assured in the Alabama River even for nine months in the year without resort to canalization, and it agrees with the district officer that the cost of such canalization will be in excess of the probable benefits to commerce. The Board concludes that under the conditions named the improvement of the Alabama River should be restricted to snagging and such construction and maintenance of works of regulation as may be practicable with a total expenditure of $25,000 annually.

I concur in the opinions heretofore expressed, that the further prosecution of the present project for improvement of the Coosa River is not justified to a further extent than either the completion of Dam No. 4 at an estimated cost of $108,500, or the extreme limit would be the completion of such dam with lock, which is now under way, and the construction of a permanent dam at site of Dam No. 5.

I also concur in the opinion expressed that an improvement contemplating a continuous 6-foot channel in the Coosa and Alabama rivers from Gadsden to the sea is not now justifiable, in view of its great cost.

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In the matter of the improvement of the section of the Alabama River from Montgomery to the mouth, it is stated in my last Annual Report that "the commerce of this stream is important, consisting principally of cotton, cotton seed, fertilizer, grain, lumber, shingles, naval stores, staves, and a large quantity of miscellaneous freight of all descriptions, estimated for the past fiscal year as 133,092 tons, valued at $13,317,000." It is also stated that "as the benefits to be derived from the improvement of the Alabama River are very great, funds should be provided for the vigorous prosecution of the work, whether a new project is adopted or not, and as the most important work under the project to secure a channel 6 feet deep will be the dredging, the small dipper dredge belonging to the improvement should be put at work, and a suitable hydraulic dredge should be constructed."

If it were certain that the estimate of $650,000, submitted by Captain Cavanaugh, would provide a channel 6 feet deep for nine months in the year, I would believe the expenditure to be justifiable. But considering the uncertainty as to securing such full results the full adoption of such project at this time does not appear to me justifiable. It is believed, however, that the appropriations heretofore made for the river have not been sufficient to maintain the improvements made, let alone securing further improvement, and I am of the opinion that the commercial interests involved will warrant a greater annual expenditure than is recommended by the Board of Engineers for Rivers and Harbors, for several years to come, so that not only may existing improvement be maintained, but that additional channel work may extend the improvement gradually toward the desired 6-foot low-water channel.

Very respectfully,

A. MACKENZIE,
Brig. Gen., Chief of Engineers, U. S. Army.

Hon. WM. H. TAFT,
Secretary of War.

SURVEY OF COOSA AND ALABAMA RIVERS, GEORGIA AND ALABAMA.

UNITED STATES ENGINEER OFFICE,
Montgomery, Ala., June 30, 1904.

GENERAL: I have the honor to submit the following report upon the Alabama and Coosa rivers, in compliance with the requirements of the river and harbor act approved June 13, 1902:

Under the terms of this act report is required both as to the feasibility and advisability of securing a 6-foot navigation in these rivers, and to obtain the necessary data for this report the unexpended balance of the appropriation for the improvement of the Coosa River between Wetumka, Ala., and the East Tennessee, Virginia and Georgia Railroad bridge was made available. As the limited amount thus made available was insufficient for complete surveys of the rivers, it was expended in obtaining the data considered most necessary for the revision of the projects and estimates for the improvement of both rivers for a 6-foot navigation.

A topographical survey was made of the banks of the Coosa River from Lock 4, Alabama, to Wetumka, Ala., a distance of 116 miles,

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and a hasty examination of the obstructions in the Coosa River from Wetumka to its junction with the Tallapoosa, a distance of 11 miles, and of the Alabama from this point to its mouth, a further distance of 312 miles. A detailed report upon the methods and results of the topographical survey of the Coosa River was made by Mr. N. A. Yuille, chief of party, and is submitted herewith as Appendix A. As soon as the results of this survey were available a thorough study of the section of the river between Lock 4 and Wetumka was made to devise a project for its improvement to secure a 6-foot navigation. Several different projects were considered, and the one finally decided upon is thought to be the most economical and best balanced that can be made from data at present available. The project provides for the construction of 15 locks and dams between Lock 4 and Lock 31, the completion of Lock 4 and Dam 31, and the necessary excavation to provide a channel between the locks not less than 7 feet deep and 150 feet wide on the bottom. This project differs from the present one in many respects. The number of locks is reduced by 11, thus reducing the time required for lockages and also the annual charge for maintenance by an amount estimated as $5,000 per lock, or $55,000 per annum. The channel between locks has been increased from 100 feet wide by 4 feet deep to 150 feet wide by 7 feet deep, to afford proper facilities for a 6-foot barge navigation; but, due to a different distribution of pools and pool levels, the extent of channel work has been reduced. The width of the locks has been increased from 52 to 56 feet, and the tops of the miter sills placed 7 feet below the crests of the dams. All dams over 20 feet in height are to be built of concrete masonry, those of lesser height to be of stone, with a crib core similar to those already constructed at the upper lock sites.

A report upon this project, with an estimate of its cost, has been prepared by Mr. D. M. Andrews, assistant engineer, and is submitted herewith as Appendix B. This report also includes an estimate of the cost of extending the 6-foot navigation from above Lock 4 to Gadsden, Ala., for such an extension would be necessary to secure the maximum benefits from the improvement; and a further extension in modified form from Gadsden to Rome, Ga., will doubtless ultimately become highly desirable.

The unit prices, types and dimensions of locks, dams, and other parts of the proposed improvement, and the general assumptions made to cover points where complete information is not available have all been carefully considered with Mr. Andrews and checked by a personal examination of the river and proposed lock sites between Lock 4 and Wetumka, and as submitted in his estimate are in accordance with my views on the subject.

As indicated in this report, it is believed to be entirely feasible to secure a 6-foot navigation from Wetumka, Ala., to the Broken Arrow coal fields above Lock 4 at an estimated cost of $8,960,706, and to extend this navigation to Gadsden, Ala., for an additional sum estimated as $1,064,000, provided the appropriations made for the improvement are sufficiently liberal to permit the work to be carried on economically and advantageously so as to complete it within less than ten years.

The practical value of any improvement of the Coosa River from Gadsden to Wetumka depends largely upon the existence of an improved channel in the Coosa and Alabama rivers from Wetumka to

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the mouth of the Alabama River, which will afford equal or better facilities than those above Wetumka, so that the route from Gadsden to the seaboard at Mobile may be complete. The feasibility and estimated cost of securing such a channel have therefore been considered as carefully as available data permit.

The first careful examination ever made of the Alabama River was by Mr. G. B. Yuille, assistant engineer, in 1875, and his description of its character and conclusions with reference to the feasibility of its improvement were as follows:

The results of the examination may be briefly stated as follows: Commencing at Wetumka, which is situated at the head of an open reach of navigable water on the Coosa River and at the foot of the last of a series of rapids that obstruct the upper portion of that river, with a width here of 400 feet, between fixed and stable banks, partly formed of gneiss rock, through which the river has made its way, it assumes a lake-like appearance, maintaining a uniform width, with a very moderate current, and depth of not less than 6 feet, till the mouth of the Tallapoosa River is reached, the junction of which with the Coosa forms the Alabama River proper.

At the mouth of the Tallapoosa we come upon the first serious obstacle to navigation, caused by an extensive deposit of coarse gravel in the channel of the united rivers, brought down the former in times of flood, filling up the bed and causing a widening of the main river, with a consequent dispersion of the water into several shifting channels, through which only about 2 feet depth is found at low-water stage. The filling up of the main river, acting as a dam, has caused a great increase of the natural inclination of the river bed below, and the formation of slack-water pools in each above the obstruction. The formation of this dam or bar in the main river is evidently the result of the very square entrance of the Tallapoosa into the Coosa, with the heavy character of deposit brought down the former and discharged into the channel of the latter, together with the very unstable nature of the adjacent river banks, allowing an undue widening to take place with the ever varying conditions of each river in flood and low water.

This disturbance of the otherwise favorable condition of the river continues for about 3 miles, when the normal character of the river is again found, with an increase of width to 500 feet since the accession of the Tallapoosa, and with a depth of from 6 to 15 feet in all open reaches of the river.

We now enter upon a portion of the river that is very uniform in its characteristics, in the character of the banks, width and depth; also in the great similarity and nature of the obstructions found; this similarity continues so long as the river is bounded, one side or the other, by high and solid bluffs.

It is therefore unnecessary to enter into a minute description of the successive obstructions found; a general illustration of the governing characteristics will be more useful.

The banks generally of the upper portion of the river are of a solid and firm nature, and in no case was there found any extensive caving or falling in. In a very large proportion the banks upon one side of the river or the other are composed of a compact soft rock or marl, usually called rotten limestone, a material that offers an effective barrier against the eroding action of the river, and which often contains ledges of a harder material, fit in many places for building stone. The bluffs also contain large quantities of nodules or concretions of a hard and solid character, that fall from the face of bluff and collect at the edge of low water, that would make suitable material for filling cribs of dams and jetties, easily gathered by boat at low water.

This general character of the river, however, is only applicable to those parts that are free from islands, bars, and shoals, of which there are great numbers, as shown upon the index map. These obstructions may be said to have resulted from the failure in resistance offered to the action of the river by one or the other of the banks, allowing an increase of width in the flood stage, and the consequent filling by timber, gravel, and sand in the unduly widened river bed during the subsidence of flood. This action has, in the course of time, divided the channel, forming islands and bars with those in a less advanced state, constituting the present shoals.

The foregoing description of character of river applies to that portion commencing near the mouth of Tallapoosa River and extends to a point between Claiborne and Gainstown, where the high bluffs come to an end. The width of the river in this portion ranges from 500 to 600 feet, and wherever that width is exceeded will be found the bars and shoals. In the open reaches of river ample water is always found, ranging from 8 to 15 feet, and often much deeper. At none of the bars or shoals

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was there found any excessive current, and in the open reaches the current did not exceed three-fourths or 1¼ miles per hour.

In this really beautiful portion of the river its usefulness is marred by many bars, shoals, and reefs, and collections of logs, at many of which points the low-water depth is reduced 3½ and even 2½ feet.

We now come to that part of the river between Gainstown and the mouth, where the width has increased to 600 and 800 feet, the depth ranging from 10 to 12 feet in the fair reaches, and upon the shoals as low as 3 feet was found for low water.

From near this point, where the high bluffs terminate, the river banks are mostly overflowed in high water and are more subject to erosion by the river. A much wider scope of the valley of river is overflowed, and we find a sudden falling off of the oscillation.

One of the most damaging obstructions of the lower river is what is known as the "cut-off," about 16 miles above the mouth of Alabama River, where the waters of the latter have of late years made an outlet through to the Tombigbee River of such magnitude as to seriously impair the volume of water passing down the Alabama. [The cut-off has been closed since 1880.]

* * * * * * *

The river below the cut-off to the mouth is as yet in good condition, requiring only the removal of logs and timber; ample water found from the cut-off to the mouth.

Owing to the unfavorable condition of the river at the commencement of the examination, no estimate of the volume of discharge could be made at a point above Montgomery, which was deemed essential to a determinate solution of the problem of maximum capacity of channel practicable. A measurement was made, however, below Montgomery, or as soon as the river was found in a favorable condition. These measurements were made when the river was reported to be about 1 foot above ordinary low water. They are submitted as approximate only. The first was taken at a point just below Newport bar, and gives 3,711 cubic feet per second with mean velocity of 2 feet per second. The second was taken at Woods Upper Landing, 20 miles lower down, and gave 3,734 cubic feet per second with mean velocity of 1.57 feet per second.

To determine inclination of river surface at low water use was made of data from railroad-survey levels and measurements of surface velocities of the river at various points.

The oscillation was determined from actual note of the high-water marks from reliable sources, and all are made from the well-established high water of the spring of 1874.

The following statement is therefore submitted with confidence that it approximates the truth:

Statement of tide-water elevations, oscillations, and estimate of volume of discharge at various points on the Alabama River.

Name of locality.	Map distance from Mobile.	Low water of river above tide water at Mobile.	Oscillation of river during high water of 1874.	Volume of water per second, low water of 1875.	Remarks.
	Miles.	*Feet.*	*Feet.*	*Cu. feet.*	
Wetumka	367	117.00	58.82	.....	River 400 feet wide at low water.
South and North Alabama Railroad bridge.	344	105.00	53.50	.....	
Montgomery	338	103.40	58.20	.....	
Newport bar, one-half mile below.	310	.....	.....	3,711	Approximate only.
Woods Upper Landing	291	.....	.....	3,734	Do.
Western Railroad bridge	264½	.....	55.00	.....	
Selma	256½	.....	53.00	.....	
Claiborne	119½	.....	42.00	.....	End of high bluffs on river.
Gainstown	95½	.....	28.00	.....	Both banks mostly overflowed during high water from this point south.
Davis Landing	69½	.....	23.00	.....	
Cut-off	60½	12.00	21.90	.....	Oscillation and elevation estimated.
Mouth of Alabama River	44½	.....	20.00	.....	
Seymores Bluff	31	.....	16.25	.....	
Mobile	00	0.00	1.00	.....	

From the above statement the average rate of inclination of the river from the cut-off to Montgomery is 0.328 foot, or about 4 inches per mile; from Montgomery to Wetumka, 0.469 foot, or 5⅝ inches per mile.

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At the most rapid part of the Tallapoosa shoal the mean velocity was determined by measurement at 4.56 feet per second, or 3.1 miles per hour, which extended about one-fourth of a mile in distance at that rate. At no other point on the river was there found such an exceptional mean velocity; therefore, without burdening this report with more data for determining the exact capacity of the river, we may safely proceed to consider plans and estimates of cost, being fully satisfied that there will be abundant volume of water to carry out any scale of improvements contemplated or the requirements which probable commerce on the river may call for.

* * * * * * *

By map measurement the total length of river examined is 322 miles, upon which were found 116 bars, shoals, and reefs that offered more or less impediment to free navigation at ordinary low-water stage of river. In prosecuting this examination there was soon developed a remarkable similarity in the character and nature of the obstructions, determining, in the mind of the observer, a common method for their remedy. In all cases where a bar or shoal was found there was an increased width of river, and where the shoal became elevated into an island and divided the channel into two chutes, thus narrowing the river, one or both chutes would be found with deep water as far as the bar or island extended. At the head of the island, where the channel was yet wide, would be found the compact gravel shoal, with shallow water; then, at the foot of the island or bar, where the river was also yet too wide, we would find the soft, shifting sand deposit and shallow water.

* * * * * * *

In submitting estimate of cost two grades of improvement are proposed: The first for a channel of 4 feet depth and 200 feet minimum width; the second of 6 feet depth and 150 feet minimum width.

The first plan contemplates such depth as may be easily secured, and at the same time the work may be made to lead in the direction of a more thorough improvement in the future.

The second plan contemplates a work of improvement that will at once secure an approximation to the full capacity of the river at low-water stage.

The 4-foot channel, it is believed, will serve the present requirements of the class of steamboats used on the river, and the execution of this work would be the first step toward a more perfect work, looking to the future development of the full capacity of river, when the increased commerce and growth of new interests shall require it.

As river improvements of this character are always in a measure experimental, there is every reason to believe that in a case like this the full result may be obtained in some places in the effort to secure only the partial. I therefore think it but the exercise of proper prudence to recommend the application of means under the first grade of improvement.

* * * * * * *

The amount appropriated for the examination not contemplating an instrumental survey of the obstructions found upon the river, it will be necessary in many cases to have a survey made before determining a plan of improvement.

Therefore to the foregoing total cost must be added an amount sufficient to cover this item, also an amount to provide for the removal of logs and trees obstructing the sides and lodged in the bottom of the river in the long reaches of open water not covered in the tabular estimate.

The total estimate will then stand as follows:

For channel of 4 feet by 200 feet:	
Total cost from tabular estimate	$204,310.00
Additional logs to remove, 500, at $10	5,000.00
Superintendence, survey, and contingencies, 10 per cent	20,431.00
Total	229,741.00
For channel of 6 feet by 150 feet:	
Total cost from tabular estimate	395,455.00
Additional logs to remove, 500, at $10	5,000.00
Superintendence, surveys, and contingencies, 15 per cent	59,318.25
Total	459,773.25

The measurements of the discharge of the Alabama River, given in the above table, are believed to be unreliable as stated by Mr. Yuille,

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for gaugings made by three different observers of the United States Geological Survey at Selma, Ala., give the discharge of the Alabama River at this point as, approximately, 7,000 cubic feet per second at ordinary low water, and by interpolation from the rating table prepared by this survey for the river at Selma the discharge at the lowest stages of the river ever known exceeds 5,000 cubic feet per second.

Measurements of the discharge of the Coosa River made in 1891 at a point 3 miles above Wetumka, under the direction of this office by Mr. Firth, assistant engineer, are in substantial accord with these figures, as they give the discharge at this point as 5,800 cubic feet per second at a stage corresponding to zero on the Wetumka gauge.

A second examination of the river was made in 1890 by Mr. C. B. Percy, assistant engineer, and its condition at that time is described by him as follows:

The amount allotted for the examination at that time did not justify any extended or connected survey. Consequently only the more important obstructions were carefully investigated, a cursory examination of the smaller islands, bars, and shoals made, and the reaches of the river merely sounded. While the detailed features of all the bars have materially changed since that date, the general characteristics have remained unaltered, so that the information and data then secured and that furnished by the surveys of the more important bars, etc., made during 1889, together with the knowledge of the river gained during the progress of the present improvement, will furnish as accurate and reliable data upon which to base an estimate of cost and a general project for a 6-foot channel as would be gained from any survey made at this time, for by the time the funds for starting the work would be made available other alterations would probably have taken place, rendering a survey of each locality necessary before determining on the plan of improvement. Therefore I would respectfully suggest that no survey be made now, and that a sufficient amount be added to the estimated cost to cover the expense of such examination as may from time to time be required.

The estimated cost of improving the channel of these rivers to a depth of 4 feet from Wetumka to the mouth of the Alabama was, according to the report of 1876, $229,741.

The total amount appropriated toward this improvement up to June 30, 1890, was $165,000, and the work done has resulted in securing a depth of 4 feet at low water, permitting an uninterrupted navigation during the entire year to boats of that draft and to those drawing 5½ feet or less during nine months, and also in securing a channel comparatively free of logs and snags, and in clearing the banks of overhanging timber dangerous to navigation, whereas at the time the survey was made "its usefulness was marred by many bars, shoals, and reefs, and collection of logs, at many of which points the low-water depth is reduced to 3½ and even 2½ feet." The entire river was much obstructed by logs and snags that were embedded in the main channel and chutes, and the banks lined with dangerous, overhanging timber. A very large portion of the amount so far appropriated has been expended in removing the logs and snags and overhanging timber, also in maintaining the improved condition of the river by the removal of the annual accumulation of similar obstructions brought into the channel and chutes by freshets and fallen timber from the caving and washing of the banks. Nothing has been expended on shore protection, and but a small proportion in contracting the stream to its normal width by jetties; this has been due to the small amount of the annual appropriations. However, in every instance where jetties have been constructed and remained in good condition a depth of 6 feet has been secured at low water, and the channel very much straightened.

The general width of the Alabama River ranges from 500 to 600 feet, and wherever this width is exceeded the bars, shoals, etc., are to be found. In the open reaches, often many miles in length, the depth at low water ranges from 8 to 25 feet; the rate of inclination is nearly uniform, and the fall at the bars is not materially increased over the average, which is about 4 inches per mile; the current nowhere exceeds 1¼ miles per hour in the reaches, and no excessive velocity is to be found in any of the chutes except at and below the junction of the Coosa and Tallapoosa rivers, where the velocity reaches the maximum of about 3.1 miles per hour, and the distance between the bars, etc., ranging from one-half to 12 miles, with an abundant volume of water at all seasons; the improvement, therefore, at each locality will be comparatively independent and will have but little effect upon those above or below. The great similarity in the general characteristics of all the obstructions admits the

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adoption of a uniform method of improvement along the entire river, and plans and estimates can be safely submitted to carry it out on any scale that may be contemplated, or that any future development of commerce may justify.

The estimate herein submitted is for maintaining the improvement by the removal of logs, snags, and other obstructions from the channel, also overhanging trees from the banks where they interfere with navigation; to protect rapidly caving banks; to construct works of contractions where needed; to increase the depth at low water to 6 feet; to excavate rock reefs and bars where the material is such as will not scour to conform to the improved channel, and finally, to carry out in connection with this work a detailed survey of the bars, shoals, islands, etc., wherever necessary.

Estimate of cost of improving the Coosa and Alabama rivers from Wetumka, on the former, to the mouth of the latter, an estimated distance of 322 miles:

Works of contraction and shore protection	$305,871
Snagging operations	30,000
Surveys, supervision of work, contingencies, etc., 15 per cent	50,380
Estimated total cost	386,251

These descriptions are still accurate, so far as the general character of the river is concerned, and the conclusions with reference to the possibility of its improvement are believed to be sound, for wherever improvement has been properly carried on satisfactory and permanent results have been secured so long as the works of regulation were maintained. Unfortunately, however, appropriations have been so small and made at such irregular intervals that no systematic improvement has been possible, work being almost entirely confined to the removal of the annual accumulation of snags and to temporary measures, to secure immediate relief at widely scattered points without any reference to a general plan, often resulting in the development of other obstructions at points lower down the river.

As the slope of the rivers from Wetumka to the mouth of the Alabama River is small and the discharge very large, according to the gaugings of the United States Geological Survey at Selma, Ala., exceeding 5,000 cubic feet per second even at extreme low water, it is believed to be entirely feasible to secure and maintain an open channel sufficient for 6-foot navigation practically throughout the year. From January 1, 1890, to January 1, 1904, a period of fourteen years, the river has afforded facilities for a 6-foot navigation for an average of over two hundred days per year without improvement, and would, with little improvement, afford facilities for a 4-foot navigation throughout the year. I am, therefore, of the opinion that the interruptions to a 6-foot navigation due to low water could be reduced below thirty days per year. With a view to determining whether or not the extreme low-water discharge of the Coosa and Alabama rivers will be sufficient for the improvement as proposed, the maximum concentration of fall was measured at points on the Tallapoosa bar, the most unfavorable part of the rivers between Wetumka and Mobile, and the result of these measurements indicated that even here, where the concentration of fall is the maximum, the extreme low-water discharge will be ample to supply the proposed channel, even without considering the local reduction in slope which will naturally result from its distribution over the entire length of the shoal. As the total fall between Wetumka and Montgomery has never been accurately determined it is possible that the improvement as proposed may give rise to excessive currents in the dredged cuts, making them difficult to maintain, or cause an excessive lowering of the lower pool at Lock 31. If such is the case it will be necessary to protect the bottoms of cuts from scour or con-

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struct a lock of low lift below the mouth of the Tallapoosa River, and the additional funds necessary for this have therefore been provided for in the estimate.

The hasty examination of the rivers recently made indicates that at extreme low water for approximately 4½ per cent of the distance from Wetumka to the mouth of the Alabama River the channel does not have a width of 150 feet and a depth of 7 feet, the reduced widths or depths being found on bars or shoals practically identical with those discovered by Mr. Yuille, except where the improvement of the river has caused some modification and at the Tallapoosa Cut-off, which has developed since. To make a channel 150 feet wide and 7 feet deep through these shoals will require the removal of approximately 18,500 cubic yards of rock and 1,200,000 cubic yards of sand and gravel.

The best method of securing this channel is believed to be by dredging, combined with such works of regulation as may be necessary to prevent the return of the dredged material into the channel and at the same time restrict the width of the low-water channel. The dredging should be done by purchasing a Government plant with sufficient capacity to remove at least 600,000 cubic yards per working season, as heavy filling of dredged cuts may be expected, particularly the first few years, and the plant should have sufficient capacity to complete the channel within five years, making a liberal allowance for the fill during this period.

The estimated cost for securing and maintaining a channel for 6-foot navigation as outlined above is as follows:

For completing the channel within seven years:	
Removing 18,500 cubic yards rock, at $2.50	$46,250
Constructing 30,000 linear feet of jetties, at $5	150,000
Construction of 2 hydraulic dredges (estimated to require two years), at $50,000 each	100,000
Operation of these dredges for five years, at an average cost of $16,500 each per year	165,000
Operation of 1 snag boat for five years	50,000
Closing Tallapoosa Cut-off	25,000
Lock below mouth of Tallapoosa River, if required	400,000
Surveys, superintendence, etc	63,750
Total	1,000,000
For maintenance after the seventh year:	
Operation of 1 snag boat, per year	10,000
Operation of dredging plant, per year	25,000
Superintendence and contingencies, including repairs to jetties, and possible operation of lock	20,000
Total	55,000

In absence of reliable data as to the degree of permanence of dredged channels in the Alabama River when combined with properly designed works of regulation, a more exact estimate can hardly be submitted, but it is believed that the improvement as outlined, even under the most unfavorable conditions, will afford a practicable channel at all times, for any reductions below a 6-foot draft that may occur during unfavorable seasons will be short and will come during the movement of cotton, for which a less draft is sufficient, and any losses to commerce in heavy freights will be practically offset by the increased draft over 6 feet that can be carried for the greater part of the year. Therefore the improvement of the Alabama River for a 6-foot navigation is, in

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my opinion, feasible within the meaning of the act of Congress approved June 13, 1902.

Considering the feasibility of providing for a 6-foot navigation in the Coosa and Alabama rivers as established, in order that such an improvement can be recommended as advisable at least two other conditions must be susceptible of demonstration: First, that the improvement will afford a cheap and practicable water route which can always successfully compete with the railroads and effectually control the transportation rates between the Coosa Valley and the seaboard; and, second, that the benefits to commerce to be derived from the improvement will be commensurate with its cost. To show that a system of barge transportation can on a 6-foot draft successfully compete with the railroads and carry the heavier classes of freight, such as coal and iron, from Gadsden and intermediate points to Mobile at a cost much below that by rail the following brief discusssion is submitted:

Both the Coosa and Alabama are large rivers, having in general an available width of from 400 to 800 feet, and when improved as provided for in the above estimates fleets of at least six barges 140 feet long by 26 feet beam can be readily handled by a single towboat. Such a fleet on a 6-foot draft will carry, approximately, 3,300 tons of coal or pig iron. The distance from Gadsden to Mobile is 537 miles, and as a tow of the above size can make an average of at least 5 miles per hour, including time lost at locks, the round trip can be made in two hundred and eighteen hours running time, or allowing one day each trip for assembling and delivering tows, washing boilers, etc., in ten days. Assuming that the time lost by floods, storms, low water, and other causes does not exceed sixty-five days per year, each towboat could make 30 trips per year and transport with its fleet 99,000 tons of freight. As the increased draft possible for the greater part of the year will more than compensate for any reduction due to low water, the above estimate for loss of time is believed to be ample to cover all contingencies.

To carry on barge transportation economically the following plant would probably be required:

For every tow in motion 6 additional barges at each terminus loading and discharging, and for every 4 towboats actually in operation 1 additional towboat, with its complement of 18 barges, in reserve. Therefore, under these assumptions, to transport from Gadsden to Mobile in one year 396,000 tons of freight, the capacity of 4 fleets, would require 5 towboats and 90 barges, and the estimated cost, returning the barges empty to Gadsden, would be as follows:

Cost of equipment:	
5 towboats, at $30,000 each	$150,000
90 barges, at $2,000 each	180,000
Total	330,000
Interest and depreciation 20 per cent	66,000
Operation of 5 towboats one year:	
5 masters, at $150 per month	9,000
10 pilots, at $125 per month	15,000
5 engineers, at $100 per month	6,000
5 engineers, at $90 per month	5,400
10 oilers, at $45 per month	5,400
5 mates, at $75 per month	4,500
20 firemen, at $50 per month	12,000
5 cooks, at $45 per month	2,700

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Operation of 5 towboats one year—Continued.	
5 cooks' helpers, at $25 per month	$1,500
15 deck hands, at $40 per month	7,200
2 carpenters, at $75 per month	1,800
Oil, waste, lines, etc	6,000
Subsistence, 87 men, at 40 cents per day	12,702
Fuel, at 20 tons per day per boat actually running, 29,200 tons, at 75 cents per ton	21,900
Total cost per year	177,102

From this discussion the cost of the transportation of heavy freights by water from Gadsden to Mobile is estimated to be less than 1 mill per ton-mile, or less than 50 cents per ton, and for compressed cotton not more than twice this amount. As the distance from Gadsden to Mobile by rail is over 325 miles, and the railroads can not profitably handle freight on hauls of this length for much less than 4 mills per ton-mile, the best rate they can offer will be more than $1.25 per ton even on the lowest grade of freight. The present railroad rate on pig iron from Gadsden and Anniston to Gulf points is $2.50 per ton of 2,240 pounds, and on compressed cotton 38½ cents per 100 from Gadsden and 34½ cents from Anniston; therefore, making a fair allowance for excess terminal charges and for maintenance of terminal facilities, a substantial saving, not less than 75 cents per ton on heavy freights, and much more on cotton and other high-grade freights, may confidently be relied upon. In this discussion no account has been taken of the return freights from Mobile to the various points in the Coosa Valley, and as this freight movement would be considerable its consideration would serve to make the above estimate of the cost of moving freight by water and the resultant benefits to commerce still more conservative.

The estimated cost of securing a 6-foot navigation from Gadsden, Ala., to Mobile, Ala., is in round numbers $11,000,000, i. e., $10,000,000 between Gadsden and Wetumka, and $1,000,000 between Wetumka and Mobile. The cost of maintaining and operating the improvement is estimated to be, for the 20 locks between Gadsden and Wetumka, including the connecting channels, $5,000 per lock, or $100,000 per annum, and for the river between Wetumka and Mobile, $55,000 per annum; therefore, in order that the improvement may be recommended as advisable, it must be evident that the benefits to commerce will at least be great enough to exceed this annual cost of maintenance plus a moderate interest on the first cost of the improvement. Computing this interest at 3 per cent, the amount which represents the minimum annual benefit permissible is $485,000.

In estimating the benefits to be derived from the improvement two quite different factors must be considered; first, the benefits to existing commerce, which can be predicted with some degree of certainty, and second, benefits to prospective commerce, which, in the nature of things, must be largely a matter of personal opinion, as their prediction depends entirely upon an estimate as to the volume of such commerce. An effort has therefore been made to present not only my conclusions, but also such data as will enable others to form an opinion as to the soundness of such conclusions.

The commerce at present actually affected by the water route under consideration is confined to the valley of the Alabama River from Montgomery south. According to the last annual report, the freight

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carried on this portion of the river from July 1, 1902, to June 30, 1903, was 145,448 tons, valued at $13,680,000, and since last September the cotton shipments from Montgomery alone have exceeded 176,000 bales, on which the minimum railroad rate to Gulf ports was $1.75 per bale; therefore, it is evident that the benefits to this local business, due to reduced freight rates on the Alabama River, would be sufficient to justify the expenditure of the amount necessary to provide adequate facilities for a 6-foot navigation from Montgomery to Mobile, and it can be assumed that one-half of the estimated cost of the project for the Alabama River and $40,000 of the annual cost of maintenance will be justified by this local traffic and need not be charged against the cost of the through commerce, or, in other words, that the assumed measure of the minimum annual benefit to this commerce may be reduced from $485,000 to $430,000.

The following detailed statement of the shipments from the Coosa Valley, which was prepared by Captain Flagler in 1900 and published in the Annual Reports of the Chief of Engineers, is believed to give a conservative idea of the value and amount of the actual shipments from the Coosa Valley that would be affected by the proposed improvement.

In addition to the commerce now on the river, stated above to be valued at $1,150,000, I have collected statistics from the main centers of production in the Coosa Valley. They are as follows, values and amounts being for outgoing shipments:

	Anniston, Ala.	Childersburg, Ala.	Rome, Ga.	Center, Ala.	Lincoln, Ala.	Riverside, Ala.	Gadsden, Ala.	Ragland, Ala.	Gaylesville, Ala.	Total.
Cotton.....bales..	70,000	5,000	65,000	8,300	3,500	330	25,000	700	1,100	178,930
Cotton seed.....tons..	2,500	1,200	500	110	2,000	100	.....	37	100	6,547
Wheat.....bushels..	2,000	.....	15,000	2,800	.....	.....	.....	.....	.....	19,800
Oats.....do....	100,000	.....	.....	2,000	.....	.....	.....	.....	.....	102,000
Corn.....do....	300,000	.....	.....	4,000	.....	6,000	.....	.....	.....	310,000
Miscellaneous agricultural products, dollars.....	50,000	.....	.....	.....	.....	.....	.....	.....	.....	50,000
Lumber.....tons..	7,500	1,000	8,000	20,000	.....	30,000	40,000	.....	.....	106,500
Cattle.....dollars..	50,000	5,000	30,000	10,000	12,500	.....	16,000	.....	.....	123,500
Iron ore.....tons..	288,000	.....	30,000	5,000	.....	.....	375,000	.....	.....	698,000
Cotton cloths.dollars..	300,000	.....	2,225,000	.....	.....	.....	1,800,000	.....	.....	4,325,000
Car works.....do....	2,000,000	.....	.....	.....	.....	.....	800,000	.....	.....	2,800,000
Iron furnaces...tons..	144,000	.....	25,550	.....	.....	.....	95,000	.....	.....	264,550
Pipe works.....do....	58,000	.....	.....	.....	.....	.....	15,000	.....	.....	73,000
Other manufactures, dollars.....	310,000	.....	610,000	.....	15,000	.....	46,000	.....	.....	981,000
Coal.....tons..	.....	.....	.....	.....	.....	.....	.....	40,000	.....	40,000
Valuation of manufacturing plant, dollars.....	2,787,500	75,000	2,038,000	.....	15,000	.....	1,665,000	.....	.....	6,580,500
Coal consumed.tons..	100,388	.....	.....	.....	.....	.....	.....	.....	.....	100,388
Coke consumed.do....	22,800	.....	.....	.....	.....	.....	.....	.....	.....	22,800
Total annual value of trade....dollars..	7,500,000	100,000	4,000,000	750,000	100,000	100,000	1,500,000	65,300	75,000	14,180,300

With the statistics from these different cities and towns I have received statements that their trade would increase 100 to 200 per cent on the opening of the Coosa, that freight rates would fall 50 per cent, etc.

While some of these estimates may be oversanguine, I believe that the present value of transportation to and from points in the valley exceeds $20,000,000 annually (I have no figures of incoming shipments); that at least 25 per cent of this amount would be transferred to the river if a water route to the Gulf was secured, and that a vast amount of new traffic would open up in iron ore, coal, and lumber

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from the rich districts lying idle in the valley. In view of the foregoing facts and the amount of money which has already been spent in improving the Coosa River, I strongly recommend that work be pushed to completion and that appropriations be made of $600,000 to $800,000 annually for the continuation of the project, which could thus be finished in six or seven years.

In a memorial prepared by the Coosa River convention in 1889 the products of the Coosa Valley directly tributary to the Coosa River which would be affected by any reduced water rates thereon are given; and while this memorial is an ex parte statement, the statistics given therein seem to admit of verification. In round numbers they are as follows:

	Tons.
Cotton and other farm products	500,000
Pig iron	670,000
Manufactured cotton goods	21,000
Manufactured iron	270,000
Lime	138,000

To which should be added the product of the new steel plant at Gadsden, Ala., which has an annual output of over 140,000 tons of nails and other manufactured steel products, making the total of the products of the valley affected 1,745,000 tons. The lumber, iron ore, and fluxing rock mentioned in the memorial are not included, as the lumber trade is largely prospective and that in iron ore and fluxing rock is considered to be principally local. The present railroad rates on these products from Gadsden and Anniston to the seaboard are as follows: Pig iron, $2.50 per long ton; lime, $2.80 per short ton; manufactured iron, $2.60 to $3.20 per short ton; cotton, uncompressed, $8.60 to $9.40 per ton; other farm products, from $2.40 per ton upward; and manufactured cotton goods, $8 per ton; therefore an average saving upon these rates of at least $1 per ton on all these products that went by water or by rail at water rates could safely be relied upon, and if no more than 25 per cent of the tonnage given in the memorial were affected this would insure a benefit to commerce exceeding the annual maintenance and interest charge given above; therefore, when the incoming shipments to the Coosa Valley are also considered, I believe that the total reduction in freight rates on the present freight movement alone will be sufficient to justify the expenditures required for the proposed improvement.

To give some idea of the prospective benefits to commerce and to indicate lines along which development may be expected to take place as a result of the proposed improvement, there are submitted herewith as Appendix C letters from the Director of the United States Geological Survey in reference to mineral resources of the Coosa Valley; letters from Mr. E. T. Schuler, president of the Alabama Steel and Wire Company, and Mr. J. M. Elliott, jr., president of the Alabama Iron and Steel Company, as to the possibilities of the development of the iron and steel industries, and letter from Mr. T. S. Kyle, manager of the Kyle Lumber Company, in reference to the possible development of the lumber industry should the Coosa River be opened and the immense tracts of timber contiguous to it, at present untouched for lack of transportation facilities, be given an outlet to foreign markets. That most of these letters are optimistic is undoubted, but the main statements made are supported by official reports, and Mr. Schuler's opinions are further supported by an ultimate investment of $5,000,000 in the plant of the Alabama Steel and Wire Company at

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Gadsden, Ala. Therefore making all due allowances for the personal bias of the writers, the possibilities of development of the lumber, iron, and steel industries of the Coosa Valley must be admitted to be very great, and with the opening of the Panama Canal and the resultant shifting of the lines of commerce toward the Gulf ports, a development sufficient to further justify the proposed improvement may confidently be expected.

In this report no stress has been laid upon the possible development of the coal trade, for it is thought that if the improvement of the Warrior River meets the expectation of its projectors, coal from the Warrior basin will, to a large extent, enjoy a monopoly of the export trade, due to its greater abundance and superior qualities as steam coal. However, there will doubtless be a large local movement of coal and limestone in connection with the iron industry, and possibly competition in the export trade, as, due to better facilities, the freight rates from the Coosa Valley ought to be as low or lower than from the Warrior basin.

Should the improvement be undertaken there will result from construction of the various dams many valuable water powers, which logically become the property of the United States, and provision should be made for disposing of them and applying the proceeds to the maintenance of the improvement. Making a liberal allowance for all possible needs of commerce the volume of water which could be utilized for this purpose would not be less than 2,500 cubic feet per second, and the total amount of water power which could be developed is estimated to be over 70,000 horsepower, of which about one-half is concentrated at the highest four dams.

It is thought that no difficulty would be found in ultimately disposing of the greater part of this power at a rental not less than $5 per horsepower per annum, for with this horsepower would go a manufacturing site on a water route to the seaboard. As an indication of the value of these powers, attention is invited to the fact that at the present time there is before Congress a bill to authorize a company to construct one of the proposed dams, including the purchase of all lands, privileges, etc., without cost to the United States, for the privilege of using the power developed. Should it be possible to sell all the power that could be developed at a fair rental, the improvement would be practically self-supporting from this source alone.

The present project for locks and dams on the Coosa River provides for a channel between locks 100 feet wide and 4 feet deep, which would afford facilities for a draft not exceeding 3 to 3½ feet. On this draft it is believed that steamboats or barge lines could not successfully compete with the railroads for through traffic, and unless this can be done the water route would not serve to regulate freight rates.

While this project contemplates an ultimate increase in the depth of the channel to 6 feet, the additional cost of this modified project will greatly exceed that of the new project herein recommended, and it will not afford equal facilities for commerce; therefore, the further prosecution of the present project is not considered to be advisable further than to complete Lock 4 and to construct a dam at lock site 5 to extend the improvement to the railroads at Riverside and Coosa Valley and render fully available the work already done.

As a summary of the results and conclusions derived from the survey and examination of the Coosa and Alabama rivers, and the con-

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sideration of existing data in reference to these, I respectfully submit the following:

It is considered feasible to secure a 6-foot navigation in the Coosa and Alabama rivers practically throughout the year, and the probable expense thereof is estimated to be not greater than $10,024,706 for the Coosa River between Gadsden and Wetumka, Ala., and $1,000,000 between Wetumka, Ala., and the mouth of the Alabama River.

The improvement for a 6-foot navigation is believed to be advisable, provided sufficiently liberal appropriations can be made to complete the improvement within less than ten years, but unless this can be done it is not considered advisable, and any small appropriations should be applied to the Alabama River below Montgomery, where the local commerce is sufficient to justify the improvement without reference to through traffic. The expenditure of small appropriations on the section between Wetumka and Lock 4, where practically no benefits can be derived from the improvement prior to its completion as a whole, is a waste of public money.

Any new project for improving the Coosa River between Wetumka and Lock 4 should contain a provision that the water power developed should become the property of the United States to be disposed of for the benefit of the improvement.

It is not considered advisable to further prosecute the present adopted project for locks and dams in the Coosa River further than to complete Lock 4 and construct a dam at lock site 5.

A map[a] of the Coosa River from Lock 4, Alabama, to Wetumka, Ala., in 4 sheets, and a profile[a] of the same section in 2 sheets, showing the proposed locations of locks, are submitted in separate package.

Very respectfully, your obedient servant,

J. B. CAVANAUGH,
Captain, Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.
(Through the Division Engineer.)

[First indorsement.]

OFFICE DIVISION ENGINEER, GULF DIVISION,
New Orleans, La., July 6, 1904.

Respectfully forwarded to the Chief of Engineers, United States Army.

The river and harbor act of June 13, 1902, provides as follows:

> And the Secretary of War shall cause a survey to be made of the Coosa and Alabama rivers with a view to determining the advisability of securing six-foot navigation in said rivers, and the probable expense thereof; the said survey shall also contain a report upon the advisability of further prosecuting the present project for locks and dams in the Coosa River. * * *

In accordance with the above provision, a survey of the Coosa River from Lock No. 4 to Wetumka and a hasty examination of the Coosa River from Wetumka to its junction with the Tallapoosa and of the Alabama from this point to its mouth have been made by Captain Cavanaugh, the district officer. Captain Cavanaugh submits a tentative project for securing a 6-foot navigation on these streams from Gadsden, Ala., to the mouth of the Alabama River at an estimated

[a] Not printed.

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cost of $11,024,706, and states that in his opinion the improvement of these streams for a 6-foot navigation is believed to be advisable, provided sufficiently liberal appropriations can be made to complete the improvement within less than ten years. Captain Cavanaugh further states that he does not consider it advisable to further prosecute the present adopted project for locks and dams in the Coosa River further than to complete Lock No. 4 and construct a dam at lock site No. 5.

The present commerce on the Coosa and Alabama rivers is almost entirely of purely local character. The annual value of this commerce, as given in the last annual report of Captain Cavanaugh, compiled from statements made by parties interested, is $10,180,000 for the Alabama and $1,975,548 for the Coosa River. With reference to the commerce on the Alabama River, in indorsement of March 3, 1902, Capt. R. R. Raymond, Corps of Engineers, stated as follows:

> Attention is invited to the fact that the Alabama River is in much better condition for navigation than it has ever been, yet only three steamers come as far as Selma, and only one of these comes to Montgomery, although in past years, before the railroads were constructed, a large fleet of steamers came to Montgomery and Wetumka. This falling off in the river traffic is due to greater conveniences offered by railroads, which are built nearer to the points of production, and to the greater regularity of railroad service.

There is nothing to show that if the Alabama River were improved to a navigable depth of 6 feet the commerce originating on the river would be greatly increased or freight rates materially reduced.

In order that the improvement of these streams to secure 6-foot navigation can be considered advisable, it should be shown clearly and conclusively that the prospective commerce to be developed along the Coosa River by the proposed improvement would be of such magnitude as to justify a first cost for improvement of $11,000,000 with an annual charge thereafter of $155,000 for maintenance and operation, these being the approximate estimates submitted by Captain Cavanaugh. In my opinion the facts presented do not justify the expenditure of anything like the sums mentioned, and I do not consider the improvement of the Coosa and Alabama rivers to secure 6-foot navigation as one worthy of being undertaken by the General Government at the present time.

I concur in the opinion of Captain Cavanaugh that it is not advisable to further prosecute the present project for locks and dams in the Coosa River further than to complete Lock No. 4, and to construct a dam at lock site No. 5, a short distance below Riverside, Ala.

H. M. ADAMS,
Lieut. Col., Corps of Engineers,
Division Engineer.

[Second indorsement.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, July 12, 1904.

Respectfully referred to the Board of Engineers for Rivers and Harbors constituted by Special Orders, No. 24, Headquarters Corps of Engineers, series of 1902, for consideration and recommendation.

By command of Brig. Gen. Mackenzie.

H. F. HODGES,
Major, Corps of Engineers.

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[Third indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., January 4, 1905.

Respectfully returned to the Chief of Engineers, United States Army, inviting attention to the Board's report of this date.

For the Board:

D. W. LOCKWOOD,
Lieut. Col., Corps of Engineers,
Senior Member of the Board.

APPENDIX A.

REPORT OF MR. N. A. YUILLE, JUNIOR ENGINEER.

MONTGOMERY, ALA., *June 27, 1904.*

CAPTAIN: I have the honor to make the following detailed report of the survey of the Coosa River, Alabama, from Lock No. 4 to Wetumka, Ala.:

Acting upon your instructions I organized survey party and commenced survey at Lock No. 4 on August 2, 1903, and completed survey and disbanded the party at Wetumka, Ala., on December 19, 1903. A distance of 116 miles was covered in five and one-half months, the first, or upper, 40 miles of river requiring three and one-third months for its survey, an average advance of 12 miles per month, and the lower 76 miles of river one and one-sixth months, an average advance of 65 miles per month.

The survey party as originally organized consisted of fifteen men, a chief of party; two transit parties, each composed of one transit man, two rodmen, and two axemen; one level party, composed of one levelman and one rodman; and one cook and his helper. After the survey had been in progress a short time it was found that it could not be completed in a single season with the party as originally organized, and two transit parties of five men each were added in the early part of October. Early in November, to further expedite the field work, the plan of the survey was slightly modified, and another level party, one messenger, and one camp mover, with two teamsters and teams, were added to the party, bringing it up to a total of thirty-two men.

The original plan of the survey was to take the topography of all land on both banks of the river that lies below a plane 30 feet above low water. On the upper 50 miles of river the banks are low and broken by many creeks, ravines, and gullies opening into the river, therefore these limits included many square miles of country, and the survey extended in some cases 10 to 12 miles up the creeks.

Two transit parties and one level party were put on each bank of the river; one transit party on each side ran a traverse line along the bank of river, taking all topography that could be reached from the traverse line, and the second transit party took as much topography up side lines as could be done without delaying the party along the bank. Each level party ran a line of levels along traverse line on one bank of river, putting in necessary bench marks. The two lines on opposite banks were connected across the river at intervals and the discrepancies were distributed at the bench marks.

Between miles 76 and 66 the banks are low and broken, but the surface of the proposed lock pool raises the original surface of the river very little, being well within the banks, so that a more complete survey than that made was not necessary for this section.

Between miles 66 and 48 above Wetumka the banks become higher as the river approaches the hills, and from mile 48 to Wetumka the hills come to water's edge, forming high, rocky, precipitous banks; therefore the results of the survey of the lower 66 miles are practically the same as secured under the original plan, for there is practically no bottom land, and the beds of creeks and ravines rise very rapidly from the river. There are very few places where the 30-foot elevation was not reached, and where it was not reached it was only a short distance beyond limit of survey.

All angles recorded by transit were read from back sight, turning to the right from 0° to 360°.

All distances were measured by stadia and all elevations of the surface of the ground off the level lines were obtained by stadia distance and vertical angle, the

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5-foot contours shown on maps being interpolated between those points of which the elevations were taken.

The field notes of the survey of each bank were kept separate and distinct, but both transit and level lines were connected at intervals with the opposite bank.

The numbers of the stations on right bank were preceded by the letter "R" and those on the left bank by the letter "L." In survey of creek bottoms, or wherever side lines were necessary, the transit party carried their own line of levels, and in numbering the stations the alphabet was used to designate the side line. Thus the stations on the first side line on left bank would be marked L 56="O" A, 1 A, 2 A, etc., showing the side line started from station L 56; and when there is a side line from a side line it would be marked thus: 4 A="O" Ab, 1 Ab, 2 Ab, etc., which shows that the second side line left the first at station 4 A. The next time it became necessary to run a side line on left bank it would be designated thus: L 172="O" B, 1 B, 2 B, etc. The alphabet was repeated when necessary, as the distance between side lines of the same letter was so great as to prevent any chance of confusion. On the main traverse lines the letter preceded the number, and on side lines the letter followed the number.

Observations on Polaris were taken at intervals to determine the true meridian, and survey was connected with section, township, and county lines wherever these could be found.

Elevations of high-water marks were taken wherever these marks could be identified.

The lines of levels for the first 42 miles of river were closed every 5 or 6 miles and discrepancies distributed on bench marks, the maximum discrepancy allowed being 0.04 foot $\sqrt{\text{distance in miles}}$.

In the lower 74 miles of river the levels on the left bank were assumed to be correct without any adjustment, those on the right bank being connected at intervals with the left bank and elevations adjusted to agree with those of left bank, the discrepancy in closing being distributed on right bank only. This plan was followed because there was not time to run check levels, and the levels on left bank were run with the better instrument by experienced levelmen and rodmen, while those on the right bank were run with a poor instrument and by less experienced men. Duplicate level notes were kept in the field by the rodmen of both level parties, both the levelmen and rodmen reading the rod independently each time, thus reducing the chance of error to a minimum. Wherever old bench marks of previous surveys could be found connection was made with them, with results as shown in the following table:

Comparison of elevations of bench marks—Surveys of 1889 and 1903.

Description.	Remarks.	Number of miles.	Original elevation, 1889.	Elevation, 1903.	Difference.
Stone post B. M. Lock 4	Good condition	116.1	510.55	510.55	0
Catalpa tree	Decayed, but intact	110.1	488.82	488.93	0.11 high.
Red elm	Badly decayed	108.8	489.18	489.28	0.10 high.
Rock at Truss Ferry	Good condition	108.0	479.07	479.17	0.10 high.
Walnut, mouth Choccolocco Creek.	Badly decayed	105.0	482.08	481.88	0.15 low.
Pier, B. and A. bridge	Good condition	101.1	494.06	494.14	0.08 high.
Rock in river	do	94.1	454.29	454.26	0.03 low.
Walnut, Glovers Ferry	Badly decayed	84.7	455.38	455.25	0.13 low.
Walnut	Very badly decayed	70.5	441.12	440.34	0.78 low.
Abutment southern bridge East Tennessee, Virginia and Georgia		68.0	452.08	453.87	1.79 high.
Lynn (described as cottonwood)	Very badly decayed	64.9	433.05	432.23	0.82 low.
Beech	do	59.0	431.08	430.25	0.83 low.
Monument "I," survey 1891	Good condition	57.3	425.11	423.98	1.13 low.
Hickory	Very badly decayed	57.0	423.95	423.22	0.73 low.
White oak, Woods Ferry		49.0	407.09	406.02	1.07 low.
Rock at narrows	Good condition	46.1	394.07	392.93	1.14 low.
Cypress at Buzzard rock	Decayed, but intact	6.9	191.40	193.82	2.42 high.
Poplar, Corn Creek shoals	Grown over, but intact	1.9	214.38	213.70	0.68 low.
Lockup, Wetumka	Good condition	0	203.90	202.98	0.92 low.
Bank wall, Lock No. 31	do	−0.1	179.37	178.42	0.95 low.
Louisville and Nashville R. R. track at depot.	G. B. Yuille, 1879	0	186.00	224.01	38.01 high.
Hotel, doorsill—Riverside Inn.	do	−0.1	174.61	212.85	38.24 high.
United States Geological Survey B. M.	Near church and depot	0	181.61	218.96	37.35 high.

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The datum with reference to which all levels are given is mean tide at Mobile, as determined from a preliminary railroad survey that crossed the Coosa River near Lock 1 in 1884 or 1885, the line level starting from a bench mark at Lock 4, which is referred to this datum. At Wetumka connection was made with the bench marks of the Firth survey of 1889, which has the same datum, and a difference of 0.92 foot was found, the elevations of the present survey being less by this amount.

Connection was also made with G. B. Yuille's levels of 1879, and the United States Geological Survey, and the elevations of the present survey found to be 38.2 feet and 37.35 feet greater, respectively, than those of these surveys. G. B. Yuille's datum plane was obtained from railroad at Wetumka, Ala. (as noted in old field notes), and purports to be mean low water at Mobile, and the datum plane of the United States Geological Survey is mean sea level brought from precise bench mark at Rome, Ga., by line run with wye level. As the elevations of these two surveys, based upon separate and distinct datums, agree quite closely, and the elevations from which that of the bench mark at Lock 4 was determined are known to be unreliable, the elevations of the present survey are probably too great by about 37 feet, but in the absence of more reliable data no change has been made on the maps.

In plotting the survey a pantograph reduction was made of Charles Firth's survey of 1889, which gave the low-water line and the river proper, and to this reduction the results of the present survey were added.

In reducing the stadia readings stadia slide rules were used and proved of the greatest assistance in reducing the twenty field books of stadia notes into vertical and horizontal distances.

The section corners and lines found and connected with during survey were plotted on the maps, and the corners near the river between those found were plotted from the township plots obtained from the records at the State capitol.

The county lines shown are the boundaries as determined from the latest acts of the legislature of record at the State capitol.

Two maps[a] of the Coosa River have been made, one a detail map on the scale of 400 feet per inch, and the other a map on a scale of 2 inches to the mile, suitable for photographic reproduction, to accompany the report to the Chief of Engineers.

A profile[a] of the river bottom, taken from Charles Firth's survey of 1889, showing the low-water surface, the proposed locations of locks and dams, and the pool elevations, has also been made to accompany the above report.

A record of bench marks and high-water elevations has been prepared for file in this office.

Respectfully submitted.

N. A. YUILLE,
Junior Engineer.

Capt. J. B. CAVANAUGH,
Corps of Engineers.
(Through Mr. D. M. Andrews, Assistant Engineer.)

APPENDIX B.

REPORT OF MR. D. M. ANDREWS, ASSISTANT ENGINEER.

MONTGOMERY, ALA., *June 28, 1904.*

CAPTAIN: I have the honor to submit the following report and estimate of the cost of securing a 6-foot navigation in the Coosa River from Lock No. 4, Alabama, to Wetumka, Ala., as provided for by act of Congress approved June 13, 1902, and of extending this navigation to Gadsden, Ala.:

The Coosa River above Lock 4 and its tributaries—the Oostenaula and Coosawattee rivers—are navigable for a distance of about 300 miles, and the Coosa, Alabama, and Mobile rivers, below Wetumka, for 323 miles.

Between the two navigable sections of this system of rivers occur shoals and rapids, covering a distance of 116 miles, and having a total fall of 324 feet.

An excellent survey of this section was made in 1889, upon which was based the present project for improving the river.

A consideration of the results of this survey showed that in order to make an intelligent revision of the existing project the topography of the banks of the river was required, and a resurvey was accordingly made to secure these data, using the maps of the survey of 1889 for the low-water line and the topography of the river itself.

This section of the river naturally divides itself, physically and geologically, into two sections, the first 68 miles in length, extending from Lock 4 to the head of

[a] Not printed.

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Weduska shoals, and passing through the sedimentary rocks of the Paleozoic era, with low banks and comparatively little fall.

The second section, 48 miles in length, extends from the head of Weduska shoals to Wetumka, passing through metamorphic rocks, generally gneiss, of pre-Cambrian origin, with great fall between high, rocky, precipitous banks. The total fall in the two sections is, respectively, 78 and 246 feet.

Hereafter in this report these two physical divisions of the river will be referred to as the first and second sections, respectively.

In the first section locks of small lift are required to prevent the destruction of much valuable farming land, but in the second section almost any lift could have been adopted without flooding much land of any value.

Three locations for locks and dams were considered—one having locks of lower lifts in the first section than those adopted and locks of high lifts (some as great as 60 feet) in the second section; another having locks with lifts as adopted in the first section and high lifts in the second section, and third, the adopted locations and lifts.

A comparison of the three plans showed a saving in favor of the adopted plan in lock masonry alone of nearly $1,000,000 over each of the others, and the adopted locations and lifts, as shown on profile, submitted herewith, are believed to be the best and most economical that can be made from data at present available.

A table showing the estimated cost of the proposed improvement is submitted herewith.

The proposed locks are to be 400 feet over all, 322 feet between hollow quoins, 56 feet wide in the clear, with 7 feet of water on the sills when the pools are level with the tops of the dams. Lock walls are 6 feet wide on top. Upper miter walls and breast walls designed to act as arches and lock walls designed to take their thrust.

The height of flood water on the dams for a discharge of 118,000 cubic feet per second, the greatest discharge at Lock 4 since 1891, has been computed, and the tops of the lock walls so placed as to be on the point of submergence when the river reaches a discharge of 118,000 cubic feet per second.

It is proposed to build the locks of Portland-cement concrete, with mortar faces, the concrete to be composed of mortar and broken stone or gravel as may be most economical at each lock.

The bottom of the lock masonry for each lock is assumed to start 4 feet below the bottom of the lock chamber to allow for inequalities in foundation.

The excavation for each lock foundation is computed to a depth of 4 feet over the entire area of the lock and wall foundations and is assumed to be rock.

The gates and valves are to be of steel, the former of the ordinary mitering pattern with horizontal framing, the latter of the balanced type, revolving on vertical axes.

The maneuvering gear estimated for is similar to that in use on the locks of the Warrior River.

In computing the cost of wing walls, excavation for wing walls and back filling, the most unfavorable conditions were assumed. As a matter of fact, it is expected that at many of the proposed sites rock will be encountered in the banks of the river, and the cost of these items materially reduced. However, this can not be safely counted upon in the absence of thorough examinations by borings.

The masonry dams are to be built of large stones embedded in concrete, or of gravel concrete where large stone is not available, and are designed to withstand a head of 20 feet above their crests, with no back pressure from below, with safety factors under this assumption not less than 3. The section of the dams is given an easy curve at crest and toe to minimize the shock of falling water. As no ice and very little drift are to be expected, the proposed dams are believed to be ample for all requirements. The only dam upon which the water will ever rise as much as 20 feet over the crest from any ordinary floods is dam No. 20, and when this occurs the dam will be practically drowned out.

The crests of the dams are held at such elevations as to minimize the channel work without undue flooding of lands.

The references for the foundation of the dams were determined from an inspection of the profile of the river bed at each location, as this profile gives the deepest water at the sites of the dams.

The notes of the recent survey and a personal inspection of all proposed sites for locks and dams show that native rock abutments for locks and dams may be expected in the second section.

Rock for building can probably be found convenient to the sites proposed for most of the locks. From Locks 10 to 20, inclusive, rock for the purpose named is abundant. At the few sites where rock may be lacking, gravel for concrete can probably be found in abundance in the bed of the river.

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Artificial abutments and levees, where rendered necessary by the character of the banks and the topography of the adjacent lands, are designed to have their tops 3 feet above the headwater on the dams, due to a freshet equal to that of 1886, the highest known.

The dam abutments are to be concrete structures and the levees are to be earth embankments with top widths of 8 feet and side slopes 1 on 2.

The levees will be subjected to pressure only during periods of high water, excepting that at Lock No. 5. This will be under pressure at all times and is provided with a core wall of concrete and has a top width of 12 feet and side slopes of 1 on 2.

The upper guide piers are to be timber cribs filled with stone, square in plan, the sides of the squares being one-half the height and spaced with 20-foot openings between them. A line of these piers will extend 400 feet from the head of each lock, upstream, and will act as a harbor for tows entering and leaving the lock. The piers will have their tops at the references of the tops of the lock walls.

The lower guide piers are to be continuous timber cribs filled with stone, trapezoidal in section, with a uniform top width of 6 feet and a bottom width of one-half the height of the pier. At locks of low lifts the lower guide piers are to be omitted altogether; at locks of highest lifts they are to be 600 feet long, and at all others 400 feet long. These piers are designed to protect tows from the waves caused by the overfall at the dams during high water, and their tops are to be 2 feet above the level of the lower pools when the locks are at the point of submergence. As the water deepens rapidly below all the dams, these guide piers are believed to be of sufficient length to afford necessary protection.

To extend the improvement above Lock 4 will require the enlargement of Locks 1, 2, and 3, the elevation of dams at Locks 1, 2, 3, and 4, and extensive channel work, particularly below Lock 3, or in lieu of the enlargement of Lock 3 and much of the channel work the construction of a new Lock 3 below Lonnergans reef and a canal from this lock to the upper pool of old Lock 3. This will require the closing of old Lock 3 with a masonry wall and raising the short dam across the foot of old canal and the construction of a drawbridge where the canal crosses the right of way of the Seaboard Air Line Railway; but this latter plan is considered to be decidedly preferable, as it costs less and affords better facilities for navigation, and it is therefore the one adopted.

The estimated cost of the extension is as follows:

CHANNEL WORK.

Between Gadsden and Lock 1:			
Rock, 2,277 cubic yards, at $3	$6,831		
Gravel, 352,000 cubic yards, at 15 cents	52,800		
		$59,631	
Between Locks 1 and 2:			
Rock, 1,629 cubic yards, at $3		4,887	
Between Locks 2 and 3:			
Rock, 1,017 cubic yards, at $3	3,051		
Gravel, 4,169 cubic yards, at 15 cents	625		
		3,676	
Between Locks 3 and 4:			
Rock, 59,552 cubic yards, at $3	178,656		
Gravel, 53,703 cubic yards, at 15 cents	8,055		
		186,711	
Total for channel work			$254,905

LOCK 1.

Raising longitudinal dam:			
Stone, 5,335 cubic yards, at $3	$16,005		
Backing, 16,687 cubic yards, at $2	33,374		
Gravel and clay, 12,956 cubic yards, at 25 cents	3,239		
		$52,618	
Raising spillway:			
Stone, 490 cubic yards, at $3	1,470		
Gravel, 570 cubic yards, at 25 cents	143		
		1,613	
Dam across river, 4 feet high, 780 feet long:			
Stone, 1,040 cubic yards, at $5	5,200		
Gravel and quarry waste, 347 cubic yards, at 25 cents	87		
Sheeting, 18,720 feet B. M., at $20	375		
Dam abutment, 174 cubic yards concrete, at $15	2,610		
		8,272	

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Removing river wall of old lock, 1,264 cubic yards masonry, at $1.50		$1,896	
Lock complete, including masonry, gates, valves, etc		81,683	
Total for enlarging Lock 1 and raising dams 4 feet			$146,082

LOCK 2.

Raising dam No. 2:			
Stone, 2,506 cubic yards, at $5	$12,530		
Gravel and quarry waste, 2,707 cubic yards, at 25 cents	677		
		$13,207	
Raising low dam from lock to levee at Woods Island:			
Concrete core, 132 cubic yards, at $8	1,056		
Riprap covering, 966 cubic yards, at $2	1,932		
		2,988	
Raising wing or guide dam, stone, 250 cubic yards, $5		1,250	
Removing river wall of old lock, 1,533 cubic yards masonry, at $1.50		2,300	
Lock complete, including masonry, gates, valves, etc		89,958	
Total for enlarging Lock 2 and raising dams 3¾ feet			$109,703

LOCK 3.

Canal from proposed lock to upper Pool 3:			
Rock excavation, 53,200 cubic yards, at $1.50	$79,800		
Earth excavation, 478,800 cubic yards, at 15 cents	71,820		
Right of way, 45.5 acres, at $20	910		
Grubbing and clearing 23 acres, at $5	115		
		$152,645	
Lock:			
Rock excavation, 5,401 cubic yards, at $2	10,802		
Earth excavation, 48,610 cubic yards, at 30 cents	14,583		
Lock complete, including gates, operating machinery, etc	134,000		
		159,385	
Drawbridge to carry Seaboard Air Line Railroad across canal		30,000	
Wall closing present Lock 3, concrete, 173 cubic yards, at $10		1,730	
Raising present Dam No. 3 1.8 feet:			
Stone, 361 cubic yards, at $6	2,166		
Gravel, 199 cubic yards, at 25 cents	50		
		2,216	
Total cost of proposed lock and canal			$345,976

MISCELLANEOUS.

Flooded lands, 1,000 acres at $20		$20,000	
Raising Dam No. 4 3 feet		10,000	
Total miscellaneous			$30,000
Superintendence and contingencies, 20 per cent			177,333
Total cost of extension to Gadsden			1,064,000

The item of contingencies has been made large to provide against possible errors in estimate due to defective or incomplete data.

So far as known no survey has been made of the 30 miles of river between Gadsden and Greensport, and the estimate of channel work is made from personal inspection and information furnished by pilots. Surveys have been made of the section of river between Greensport and Lock 4, and the estimate for improving that section of the river is therefore more accurate. The amount of overflowed lands can not be accurately determined in the absence of a topographical survey of the adjacent lands, but from personal knowledge of the country and the results of the survey below Lock 4 the allowance made for this item is believed to be ample.

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The overfall at the dams below Lock 4 for a discharge of 118,000 cubic feet per second was determined by means of Weisbach's formula, and the slope of the water surface between the dams by means of Ppiree's formula. The value of the constant m in the Weisbach formula was taken as 0.70 instead of 0.80, as given by Weisbach, for a study of the observed overfalls at Dam 4 showed that this value of m in the formula gave results closely approximating those actually observed.

Unit prices are based on prices for similar work in this section, and those not given in the estimate sheet are as follows:

Concrete, lock masonry	per cubic yard	$7.50
Metal for gates erected	per pound	.05½
Metal for valves erected	do	.05½
Miscellaneous fittings, forgings, etc	do	.10
Excavation for foundation, rock	per cubic yard	2.00
Excavation for land and wing walls:		
Rock	do	2.00
Earth	do	.40
Back fill behind land walls	do	.25
Cast-iron culvert linings, erected	per pound	.05
Paving, stone	per cubic yard	3.00
Dam masonry:		
Stone embedded in concrete	do	6.00
Dry rubble over crib core	do	3.00
Concrete, abutment masonry	do	9.00
Earth filling, levees	do	.25
Guide piers, cribs filled with stone	do	2.00
Channel excavation, rock	do	3.00
Flooded lands and reservations	per acre	20.00

Respectfully submitted.

D. M. ANDREWS,
Assistant Engineer.

Capt. J. B. CAVANAUGH,
Corps of Engineers.

Estimate of cost of improving Coosa River, Ala., from Lock No. 4 to Wetumka.

Lock No.	Locks.							
	Miles from Wetumka.	Lift.	Guard.	Height.	References.		Masonry, including wing walls.	
					Upper pool.	Lower pool.	Cubic yards.	Cost.
5	105¼	7.30	11.00	25.3	482.30	475.00	10,459	$78,442
6	96.2	16.00	10.00	33.0	475.00	459.00	20,651	154,882
7	92.1	13.00	9.00	29.0	459.00	446.00	13,728	102,960
8	87.9	8.00	13.50	32.5	446.00	438.00	17,976	134,820
9	79.8	11.00	15.00	37.0	438.00	427.00	24,079	180,598
10	56.6	17.00	8.50	36.5	427.00	410.00	22,281	167,107
11	45.3	22.00	8.00	41.0	410.00	388.00	27,036	202,770
12	40.3	36.00	9.50	56.5	388.00	352.00	66,190	496,425
13	35.6	36.00	9.50	56.5	352.00	316.00	54,522	408,915
14	31.7	27.00	9.50	47.5	316.00	289.00	46,422	348,165
15	19.5	35.00	11.00	57.0	289.00	254.00	64,551	484,133
16	14.0	28.00	8.00	42.0	254.00	281.00	31,839	238,792
17	10.7	21.00	9.50	41.5	231.00	210.00	31,934	239,505
18	7.5	20.00	11.50	42.5	210.00	190.00	27,998	209,970
19	2.0	22.00	14.00	47.0	190.00	168.00	38,515	288,863
20	.....	15.33	11.37	34.7	168.00	152.67	.....	.....

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Estimate of cost of improving Coosa River, Ala., from Lock No. 4 to Wetumka—Continued.

Lock No.	Locks.					
	Gates.			Valves and gear, cost.	Excavation for foundation.		Miscellaneous fittings, cost.
	Weight.	Cost.	Maneuvering gear, cost.		Cubic yards.	Cost.	
	Pounds.						
5	167,498	$9,212	$1,000	$5,335	5,422	$10,844	$300
6	193,414	10,638	1,000	5,388	6,447	12,894	300
7	174,073	9,574	1,000	5,335	6,068	12,136	300
8	205,019	11,276	1,000	5,335	6,400	12,800	300
9	228,228	12,553	1,000	5,335	6,827	13,654	300
10	204,438	11,244	1,000	5,388	6,779	13,558	300
11	216,622	11,914	1,000	5,442	7,449	14,898	300
12	282,380	15,531	1,000	5,602	9,010	18,020	300
13	282,380	15,531	1,000	5,602	9,010	18,020	300
14	247,567	13,616	1,000	5,548	8,103	16,206	300
15	290,117	15,956	1,000	5,602	9,061	18,122	300
16	220,490	12,127	1,000	5,442	7,550	15,100	300
17	224,358	12,340	1,000	5,442	7,499	14,998	300
18	235,968	12,978	1,000	5,442	7,615	15,230	300
19	267,277	14,700	1,000	5,442	8,053	16,106	300
20	194,689	10,708	1,000	5,388	.....	.....	300

Lock No.	Locks.						
	Excavation for land and wing walls.			Back fill behind land walls.		Cast-iron culvert linings.	Stone paving.
	Earth.	Rock.	Cost.	Earth.	Cost.		
	Cubic yds.	*Cubic yds.*		*Cubic yds.*			
5	1,442	.....	$577	20,170	$5,043	.....	666
6	15,578	.....	6,231	35,026	8,756	.....	666
7	5,158	.....	2,061	17,880	4,470	.....	666
8	3,113	.....	1,245	22,763	5,691	.....	666
9	22,116	.....	8,846	17,915	4,479	.....	666
10	4,946	.....	1,978	37,632	9,408	.....	666
11	8,964	.....	3,586	30,891	7,723	.....	666
12	18,277	.....	7,311	106,400	26,600	$5,000	.....
13	8,659	2,644	8,752	13,948	3,487	5,000	.....
14	24,404	.....	9,762	43,283	10,821	5,000	.....
15	24,538	.....	9,815	38,746	9,687	5,000	.....
16	13,004	.....	5,202	59,007	14,752	.....	.....
17	13,027	.....	5,211	38,039	9,510	.....	.....
18	9,422	.....	3,769	22,905	5,726	.....	.....
19	3,739	.....	1,496	11,918	2,978	.....	666
20	.....	.....	.....	.....	.....	.....	666

Lock No.	Dams.							
	Lift.	Height.	Length.	Reference of crests.	Contents in cubic yards.		Cost.	Computed height of flood water on dams.
					Masonry.	Cribs.		
5	7.3	12.3	1,050	482.30	.....	16,002	$48,006	10.53
6	16.0	21.0	1,100	475.0	19,349	.....	116,094	9.37
7	13.0	16.0	1,250	459.0	.....	28,887	86,661	8.64
8	8.0	16.0	900	446.0	.....	20,700	62,100	13.02
9	11.0	19.0	650	438.0	.....	19,890	59,670	14.62
10	17.0	25.0	1,400	427.0	28,952	.....	178,712	7.97
11	22.0	28.0	1,600	410.0	39,312	.....	235,872	7.30
12	36.0	42.0	1,200	388.0	55,776	.....	334,656	8.84
13	36.0	42.0	1,200	352.0	55,776	.....	334,656	8.84
14	27.0	32.0	1,200	316.0	35,652	.....	213,912	8.84
15	35.0	41.0	900	289.0	40,203	.....	241,218	10.62
16	23.0	29.0	1,600	254.0	41,504	.....	249,024	7.30
17	21.0	25.0	1,150	231.0	28,782	.....	142,692	9.02
18	20.0	27.0	870	210.0	20,201	.....	121,206	10.87
19	22.0	29.0	650	190.0	16,861	.....	101,166	13.68
20	15.33	28 to 0	1,460	168.0	(a)	.....	27,892	27.96

a 1,663, at $7.50; 2,570, at $6.

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Estimate of cost of improving Coosa River, Ala., from Lock No. 4 to Wetumka—Continued.

Lock No.	Abutments.					Levees.			
	Guard.	Height.	Reference of tops.	Contents.	Cost.	Length.	Reference of tops.	Contents.	Cost.
				Cubic yds.				*Cubic yds.*	
5	18.7	31.0	501.0	940	$8,460	1,390	501.0	[a] 3,651 [b] 9,182 [c] 49,462	$47,072
6	17.0	38.0	492.0	1,549	13,941	81	492.0	671	168
7	16.0	32.0	475.0	1,014	9,126	80	475.0	641	160
8	22.5	38.5	468.5	1,602	14,418	1,740	468.5	9,747	2,437
9	25.0	44.0	463.0	2,267	20,403	2,830	463.0	28,159	7,040
10	14.5	39.5	441.5	1,771	15,937	55	441.5	595	149
11	13.5								
12	16.0								
13	16.0								
14	16.0	[d]	[d]	[d]	[d]	[d]	[d]	[d]	[d]
15	19.0								
16	13.5								
17	16.5								
18	19.5								
19	23.5	52.5	213.5	3,657	32,913	450	213.5	3,346	837
20									

Lock No.	Guide piers.							Channel excavation.	
	Upper.			Lower.				Rock.	Cost.
	Reference of tops.	Contents.	Cost.	Reference of tops.	Length.	Contents.	Cost.		
		Cu. yds.				*Cu. yds.*		*Cu. yds.*	
5	493.30	1,462	$2,924					9,259	$27,777
6	485.0	3,100	6,200	472.0	400	2,267	$4,534	5,555	16,665
7	468.0	1,867	3,734	464.0	400	2,507	5,014	12,375	36,945
8	459.5	2,950	5,900						
9	453.0	4,367	8,734					5,555	16,665
10	435.5	4,303	8,606	423.5	600	4,479	8,958		
11	418.0	5,184	10,368	406.5	600	5,513	11,026		
12	397.5	12,894	25,788	370.5	600	5,513	11,026		
13	361.5	12,894	25,788	332.5	600	4,824	9,648		
14	325.5	6,778	13,556	310.5	600	6,368	12,736		
15	300.0	13,019	26,038	268.0	600	4,000	8,000		
16	262.0	5,040	10,080	246.0	600	3,761	7,522	1,630	4,890
17	240.5	4,968	9,936	228.0	600	4,644	9,288		
18	221.5	5,703	11,406	210.5	600	6,647	13,294		
19	204.0	7,708	15,416	201.0	600	12,444	24,888		
20	179.37	3,942	7,884					13,800	41,400

[a] Concrete. [b] Excavation. [c] Fill. [d] Native rock.

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Estimate of cost of improving Coosa River, Ala., from Lock No. 4 to Wetumka—Continued.

Lock No.	Overflowed lands.					Miscellaneous.		Total cost.
	Computed flood heights.		References to which acreage is computed.	Acres.	Cost.	Reservations (50 acres each).	Lock houses, fencing, and outbuildings.	
	Upper pool.	Lower pool.						
5	492.83	488.63	491	414	$8,280	1,000	5,000	$259,938
6	484.37	470.04	482	1,035	20,700	1,000	5,000	385,057
7	467.64	461.89	465	214	4,280	1,000	5,000	290,422
8	459.02	455.75	452	182	3,640	1,000	5,000	267,628
9	452.62	439.79	445	279	5,580	1,000	5,000	351,518
10	434.97	421.48	434	1,447	28,940	1,000	5,000	452,951
11	417.30	404.57	417	890	17,800	1,000	5,000	529,365
12	396.84	368.54	397	270	5,400	1,000	5,000	958,659
13	360.84	330.17	361	213	4,260	1,000	5,000	846,959
14	324.84	308.36	324	151	3,020	1,000	5,000	659,642
15	299.62	265.80	298	425	8,500	1,000	5,000	839,371
16	261.30	243.76	261	88	1,660	1,000	5,000	571,891
17	240.02	225.88	238	152	3,040	1,000	5,000	459,262
18	220.87	208.27	218	64	1,280	1,000	5,000	407,601
19	203.68	198.90	197	78	1,460	1,000	5,000	514,231
20	196.96	196.67	175	.....	.....	.....	.....	95,238
Total cost, Locks 5–20, inclusive.	.....	.....	.....	.....	.....	.....	.....	7,889,733
Contingencies, 10 per cent.	.....	.....	.....	.....	.....	.....	.....	788,973
To finish Lock No. 4.	.....	.....	.....	.....	.....	.....	.....	282,000
Grand total	.....	.....	.....	.....	.....	.....	.....	8,960,706

U. S. ENGINEER OFFICE,
Montgomery, Ala., June 28, 1904.

Respectfully submitted to Capt. J. B. Cavanaugh, Corps of Engineers, U. S. Army, with report of this date.

D. M. ANDREWS,
Assistant Engineer

APPENDIX C.

LETTER OF THE DIRECTOR OF THE UNITED STATES GEOLOGICAL SURVEY.

DEPARTMENT OF THE INTERIOR,
UNITED STATES GEOLOGICAL SURVEY,
Washington, D. C., May 20, 1904.

SIR: I beg to acknowledge the receipt of your letter of May 14, relating to the geology and natural resources of Coosa Valley, Alabama. The sketch printed as Senate Document No. 65, Fifty-sixth Congress, is a fairly satisfactory statement of the subject, and I see no reason for making any material change in it at the present time.

One mineral resource of the region, not mentioned in that statement, is cement material. The cement industry has recently been extensively developed in Alabama and will probably very greatly increase in importance in the near future. The region is favorably located for supplying the cement which will be required in the construction of the Panama Canal, and its advantages will be greatly increased by the improvement of the Coosa River, both for the transportation of the cement to Gulf ports and by cheapening transportation of coal from the Alabama coal fields to the cement plants.

I am sending you under separate cover a recently published report on the cement resources of Alabama, and also a report on the Southern Appalachian coal fields. In case any statement is published regarding the mineral resources of the Coosa Valley, portions of these reports may be considered appropriate for incorporation.

Very respectfully,

CHAS. D. WALCOTT,
Director.

Capt. J. B. CAVANAUGH,
Corps of Engineers, U. S. A

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LETTER OF THE DIRECTOR OF THE UNITED STATES GEOLOGICAL SURVEY.

DEPARTMENT OF THE INTERIOR,
UNITED STATES GEOLOGICAL SURVEY,
Washington, D. C., January 2, 1901.

DEAR SIR: In reply to your letter of December 31, I send you with this a brief sketch of the geology and natural resources of the Coosa Valley.

GENERAL RELATIONS.

The Coosa Valley in Alabama occupies the southern extremity of the great Appalachian Valley belt, which extends northeastward to central New York. This belt is characterized by a peculiar geologic structure. The rocks, originally deposited in horizontal layers on the sea bottom, have been so folded that their beds now have all possible attitudes between horizontal and vertical. The great arches and troughs into which the beds were folded have been subsequently eroded down to a nearly even surface. The harder beds, however, are eroded less rapidly than the softer ones, and hence the beds of sandstone and chert form narrow ridges, while the limestone and shale form intervening level valleys.

The various shoals and rapids which obstruct the course of the Coosa River are due to these harder rocks crossing its channel. Where the river follows a belt of soft rocks, as is generally the case, its channel is deep and free from obstructions. It results from this structure that the various rock formations outcrop in long, narrow, parallel belts. Within this folded belt, therefore, is found a much greater diversity in the character of the rocks which form the surface than in regions where the beds are nearly horizontal. There is a corresponding greater diversity in topography and soil and in mineral deposits and agricultural products.

GEOLOGICAL FORMATIONS OF THE COOSA VALLEY.

The rocks which form the land surface in the Coosa Valley embrace representatives of all the great subdivisions of the Paleozoic, together with some formations both older and younger than the Paleozoic. Briefly enumerated they are as follows, beginning with the oldest and passing up in the geologic scale to the youngest or most recently deposited:

Archæan.—This embraces some of the highly crystalline rocks, granites, and schists along the course of the Coosa just before it enters the coastal plain.

Algonkian.—This group embraces the oldest sedimentary rocks, mostly schists and slates with beds of crystalline marble, which have been highly altered by heat and pressure and by the intrusion of various rocks in a molten state. The formations belonging to this period occupy a broad belt between the older and more highly crystalline Archæan rocks on the southeast and the unaltered formations of the Appalachian Valley belt on the northwest.

Cambrian.—This group embraces the oldest fossiliferous rocks of this region, consisting chiefly of limestones and shales, with some sandstones. They underlie the broad valley of the Coosa from Rome southwestward to Gadsden, and form smaller belts farther south.

Silurian.—This group embraces a great variety of rocks, including beds of dolomite several thousand feet in thickness, beds of pure limestone, sandstone, shale, marble, and iron ore. These various formations occupy long, narrow belts, nearly, but not quite, parallel with the course of the river, and broader belts along the eastern margin of the valley.

Devonian.—This group, which is elsewhere represented by several hundreds or even thousands of feet of shale and sandstone, yielding a sterile soil, is either absent from the Coosa Valley or is represented by only a few feet of black shale.

Carboniferous.—This group embraces beds of limestone below and beds of sandstone, shale, and coal above. These beds occupy broad shallow troughs along the western margin of the valley.

After all these rocks, from Algonkian to Carboniferous, had been deposited in nearly horizontal beds on the sea bottom the region was elevated and the beds were first folded and then eroded, the region remaining above sea level for a long time. Finally it was slightly depressed and the sea encroached some distance upon the dry land. The later formations of the Gulf coastal plain were then laid down, and they have remained in part unconsolidated up to the present.

Cretaceous.—This group embraces the gravels, clays, and rotten limestone which overlie the eroded surface of the older formations at the southern extremity of the Appalachian belt. These beds form the southern margin of the Coosa Valley, while the river is still flowing on the older rocks to the north and underlie the entire valley after it enters the coastal plain.

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Only the larger groups are enumerated above, and these have been subdivided into no less than twenty distinct formations, all occurring within a belt less than 10 miles wide on either side of the Coosa River. This indicates the extreme diversity in the character of the rocks and in the soils and mineral deposits of this region.

MINERAL RESOURCES OF THE COOSA VALLEY.

The more important mineral resources of the Coosa Valley are gold, lead, iron ore (red hematite or fossil ore and brown hematite or limonite), aluminum ore (bauxite), coal, marble, limestone, fire clay, potter's clay, and barite.

Gold.—The slates and crystalline schists over which the Coosa River flows for 25 miles before it enters the coastal plain at Wetumka are intersected by numerous gold-bearing veins which, although the ore is generally low grade, contain a very large amount of the metal and can be worked at a profit wherever transportation facilities are favorable.

Lead.—Galena or lead ore occurs at numerous localities in the Coosa Valley, occupying fissures and cavities in the Cambrian and Silurian limestones. It will probably be an important product of the region when fully developed.

Iron ore.—Two distinct varieties of iron ore are found in this region. The red hematite or fossil ore occurs in the form of a regularly stratified bed associated with certain Silurian sandstones. It is known to occur more or less continuously throughout the entire Appalachian belt, but it reaches its greatest development, both in quantity and quality, in Alabama. It supplies the furnaces at Rome, Round Mountain, Gadsden, and Attalla, all on the Coosa River, besides the very large number of furnaces of the Birmingham district, only 30 miles distant. The supply of this red ore in sight is sufficient to meet a demand much larger than the present for many years to come.

The brown hematite, or limonite ore, occurs in irregular deposits associated with the Cambrian and Silurian formations, and is connected in its origin with their weathering. A belt of these deposits extends from the vicinity of Rome southwestward more than 100 miles along the eastern margin of the Coosa Valley. It is probable that this belt contains more brown iron ore than all the rest of the Appalachian province combined, and it is nowhere more than 15 or 20 miles from the Coosa River. It supplies ore to the furnaces at Rome, Cedartown, Ætna, Tecumseh, Rock-run, Anniston, Mumford, and Talladega, and besides furnishes a large amount of ore for shipment to the Birmingham district and elsewhere.

Aluminum ore.—Bauxite, the ore from which aluminum is now obtained, occurs in commercial quantities so far as known at only two localities in the United States. One of these is a belt extending from the vicinity of Rome southwestward to Anniston, a distance of about 50 miles. The production in this district has increased from 728 tons in 1889 to 30,235 tons in 1899. All of this ore is shipped to distant markets, but on account of the heavy transportation charges is able to compete with foreign ore only by reason of its greater purity.

Coal.—The Coosa River flows along the eastern margin of the Black Creek and Coosa coal basins, while the Cahaba and Warrior basins lie but a short distance to the westward. All four of these basins, and consequently the greater part of the Alabama coal field, may be regarded as directly tributary to the Coosa River. The production of this field in 1899 was over 7,500,000 tons, and it is capable of an indefinite increase.

Marble.—Associated with the Algonkian slates, along the eastern margin of the Coosa Valley, are beds of crystalline marble of the finest quality for building and statuary purposes. They are as yet wholly undeveloped, chiefly because of the heavy charges for transportation to market.

Limestone.—Several formations of the Coosa Valley afford limestone and dolomite suitable for the manufacture of lime and for fluxing purposes.

Clay.—Raw materials admirably adapted for use in the clay-working industries are abundant in this region, but as yet practically undeveloped. They include clays suitable for refractory, building, and pottery purposes.

Minor minerals.—A considerable number of other minerals occurring in commercial quantities in this region might be mentioned. Among the more important are barite or heavy spar, yellow ocher, silica for polishing purposes, graphite, mica, and feldspar.

The above brief enumeration of the mineral products of the Coosa Valley amply confirms the statement made earlier in this letter that the region is one of exceptionally rich and diversified resources.

Very respectfully,

CHAS. D. WALCOTT,
Director.

Hon. JOHN T. MORGAN,
United States Senate.

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LETTER OF THE ALABAMA STEEL AND WIRE COMPANY, BIRMINGHAM, ALA.

GADSDEN, ALA., *February 17, 1904.*

DEAR SIR: In reply to your inquiry I beg to give as among the reasons that led the Alabama Steel and Wire Company to build its furnace and steel plant at Gadsden instead of the Birmingham district the following:

We could not obtain a supply of water in the Birmingham district for manufacturing purposes without buying it from the city waterworks at so much per thousand gallons.

The drinking water supplied by the waterworks at Birmingham is very bad, indeed; so much so that summer before last one-third of our men averaged off duty sick all the time.

While we succeeded in getting a tract of coal land adjacent to Ensley suitable for steam and coking purposes, it was the last piece available, all the rest being owned by the large companies, and there was no chance of increasing our supply for possible increased needs.

The ore lands adjacent to Birmingham are all taken up and owned by the large companies, so that there is no room in the Birmingham district for one single large company to acquire coal and ore properties.

In the Gadsden district there is room for twenty large companies to acquire both coal and ore property, and the ore property especially is more desirable for the manufacture of iron, being richer in metallic iron and containing less silicon than that in the Birmingham district.

Birmingham is a mining community in every sense of the word. It lies in an unproductive country; provisions and supplies of all kinds must be shipped in from without the State, and on this account and also on account of the bad quality of the drinking water it can never be successful as a manufacturing point, except for the manufacture of the raw pig iron itself.

Birmingham being a mining community, the labor conditions are necessarily bad and not favorable for manufacturing.

At Gadsden we find none of the disadvantages named above as applying to the Birmingham district. There is plenty of good water here, both for drinking and manufacturing purposes; it is a much healthier community; there is plenty of coal and ore for all time to come, and the ore is of better quality than that near Birmingham, and, moreover, the two are found close together; the valley of the Coosa and the adjacent Sand Mountain are capable of furnishing provisions and supplies for a city of almost any size, and the labor conditions are all that we can desire.

No proper estimate of the future of the Gadsden district can be made without taking into account the vast mineral resources in coal, ore, and limestone which are found in this district, practically one adjoining the other.

With regard to iron ore and coal, the following is an extract from a letter of the Director of United States Geological Survey on the mineral resources of the Coosa Valley, in the State of Alabama, dated Washington, January 2, 1901:

"*Iron ore.*—Two distinct varieties of iron ore are found in this region. The red hematite, or fossil ore, occurs in the form of a regularly stratified bed associated with certain Silurian sandstones. It is known to occur more or less continuously throughout the entire Appalachian belt, but it reaches its greatest development, both in quantity and quality, in Alabama. It supplies the furnaces at Rome, Round Mountain, Gadsden, and Attalla, all on the Coosa River, besides the very large number of furnaces of the Birmingham district, only 30 miles distant. The supply of this red ore in sight is sufficient to meet a demand much larger than the present for many years to come.

"The brown hematite, or limonite ore, occurs in irregular deposits associated with the Cambrian and Silurian formations, and is connected in its origin with their weathering. A belt of these deposits extends from the vicinity of Rome southwestward more than a hundred miles along the eastern margin of the Coosa Valley. It is probable that this belt contains more brown ore than all the rest of the Appalachian province combined, and it is nowhere more than 15 or 20 miles from the Coosa River. It supplies ore to the furnaces at Rome, Cedartown, Ætna, Tecumseh, Rockrun, Anniston, Mumford, and Talladega, and besides furnishes a large amount of ore for shipment to the Birmingham district and elsewhere.

"*Coal.*—The Coosa River flows along the eastern margin of the Black Creek and Coosa coal basins, while the Cahaba and Warrior basins lie but a short distance to the westward. All four of these basins, and consequently the greater part of the Alabama coal field, may be regarded as directly tributary to the Coosa River. The production of this field in 1899 was over seven and a half million tons, and it is capable of an indefinite increase."

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Considering only the coal fields directly tributary to the Coosa River at Gadsden, and not taking into account any of the coal fields tributary to Birmingham on the west, the surface indicates a total area of about 2,120 square miles underlaid with steam and coking coal.

Wherever any developments or investigations have been made at least three seams have been found, each of which will average 4,000 tons of coal per acre, or a total of 5,415,200,000 tons of available coal in one seam.

Of iron ore there is immediately tributary to Gadsden about 90 miles in length of ore veins, which, counting on being available for one-half mile only from the outcrop, indicates of available iron ore over 1,200,000,000 tons without taking in account the brown ore fields, of which there is no way of getting any intelligent estimate of the tonnage contained. The available area of each vein might very well be figured 1 mile or more from the outcrop instead of one-half mile, doubling the tonnage figures named above.

Limestone of a most excellent quality for fluxing purposes lies in no case farther than 1 or 2 miles from all the outcrops of ore seams, and in absolutely inexhaustible quantities.

Where so much mineral wealth is brought together adjacent to a river running to tide water and giving sufficient volume of water for navigation purposes, it seems there could be no possible doubt about the river being eventually made navigable to tide water, and that without any very great lapse of time—simply until the proper attention is called to the natural riches of the adjoining territory.

On account of the limited market afforded by the South the total product that we can dispose of in our immediate territory is limited, but as soon as the Coosa River is made navigable it will open up a channel of communication that will enable us to dispose of our product anywhere along the Atlantic coast, in Cuba, Porto Rico, Mexico, Central and South America, and in fact open up to this section the entire markets of the world via the cotton vessels that go from our Gulf and Atlantic ports, all needing something for ballast along with their cargoes of cotton.

We are confident that we have made no mistake in locating our industry in this place instead of in the Birmingham district, and we feel that it is only a question of time when the markets for which we are looking to become available by the opening of the Coosa River will be open to us.

The capacity of our present steel plant will be 400 tons per day, which we expect to double just as soon as our market is extended.

Yours, truly,

ALABAMA STEEL AND WIRE COMPANY,
E. T. SCHULER, *President.*

Capt. J. B. CAVANAUGH,
United States Engineer.

LETTER OF MR. J. M. ELLIOTT, JR., PRESIDENT, ALABAMA IRON AND STEEL COMPANY.

GADSDEN, ALA., *March 1, 1904.*

DEAR SIR: Referring to your conversation and request for information as to extent of iron-ore and coal fields in which I am interested near Gadsden, Ala., I beg to advise that the Alabama Iron and Steel Company, of which I am president, own and control over 7,000 acres of iron-ore lands, located in Etowah County, commencing about 11 miles west of Gadsden, on the Nashville, Chattanooga and St. Louis Railroad, at a station called Littleton, and extending southwesterly a distance of about 9 miles, a continuous ore vein of from 4 to 15 feet in thickness and estimated by competent engineers to contain over 100,000,000 tons of workable ore. This ore is of the highest grade of red hematite in north Alabama, and analyzes from 46 to 58 per cent of iron. This ore is accessible to furnaces located on the Coosa River at Gadsden, and while it is undeveloped for want of transportation, ores similarly located, when given transportation, have been worked and delivered at the furnace at a cost of 45 cents per ton. Within close proximity, not exceeding 300 yards, of this vein of ore is lime rock of highest quality for fluxing purposes, and within 2 miles, on a direct line, commence the coal fields which are owned by the Elliott-Chapman Coal and Coke Company, of which I am president. We own and control of this field about 14,000 acres, on which are three seams of coal; two of them as good coking coal as there is in the Birmingham district, averaging about 4 feet in thickness, and one vein of 30 inches to 3 feet of steam coal. This is known as the Blount Mountain coal field,

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and is estimated to carry about 200,000,000 tons of coal. One of the veins, to wit, the steam coal, is being worked and the quality is said to be equal to the best in Alabama.

With the railroad now building into these iron-ore and coal fields cheap transportation will be given to Gadsden, on the Coosa River, where iron can be manufactured as cheap, if not cheaper, than at any point in the South.

With the opening of the Coosa River this great deposit of iron and coal will doubtless be developed to a large extent in the near future.

Besides these deposits in which I am interested there are ore and coal lands within close proximity of the Coosa River near Gadsden the tonnage of which I have not had carefully estimated, but from the best information I can get the total tonnage would amount to double that above named; so that I feel I am justified in saying that the development in north Alabama is only in its infancy, and that the one thing needed above all others to bring about that development which will make north Alabama the Pittsburg of the South is the opening of the Coosa River so as to give it water transportation to the Gulf.

There are deposits of iron ore and coal along the banks of the Coosa River other than those about which I have written you, and of which you probably already have information; but if not, I will be pleased to answer further any inquiries you may make.

Yours, very respectfully,

J. M. ELLIOTT, Jr.

Capt. J. B. CAVANAUGH,
United States Engineer.

LETTER OF MR. T. S. KYLE, MANAGER, THE KYLE LUMBER COMPANY.

GADSDEN, ALA., *March 3, 1904.*

DEAR SIR: Mr. W. P. Lay has informed me of your request that I state briefly what benefit timber owners would derive from opening the Coosa River to navigation.

Not having the census reports or other definite data my estimate as to the amount of wooded area in the counties contiguous to the Coosa River is not altogether reliable. There are eleven counties in the valley which would feel the benefit of any decrease in freight rates. These counties have an area of 4,195,200 acres. It is estimated by those familiar with the counties that one-half (approximately) is timbered, or 2,097,000 acres. Estimating the yield of merchantable timber at 2,500 feet per acre board measure, we would have 5,242,000,000 feet of standing timber at this time.

As the work projected by the Government is of a permanent nature, the natural growth of timber should be considered. The Government Forestry Department have by careful survey been able to determine the growth annually, and find it to be 6 per cent. Owing to the mountainous character of the counties bordering the Coosa River, there will be a large wooded area for many years to come.

Upon examination I find that shippers of lumber in the Coosa Valley pay largely more freight to northern markets than is paid by shippers from points in Alabama upon railroad lines bordering the Tennessee River. For example, the freight rate on lumber from Stevenson, Ala., to Buffalo, N. Y., is 22½ cents per hundred pounds, or approximately $2.25 per thousand in favor of the Tennessee River Valley point. Right here I will call attention to the fact that the distance by rail is approximately the same.

In my judgment, if the Coosa River was open to navigation and lumbermen in the Coosa Valley had water transportation to the Gulf, which would place them in position to bid for export trade, the railroads in this territory would quickly establish rates which would make it profitable to the shippers to continue to use their lines, which would mean at least a reduction of $2 per thousand in freight rates to large distributing points. Such a reduction upon the standing timber of merchantable character at this time (to say nothing of the future) would mean $8,000,000 increased value to timber holders in the Coosa Valley.

If I can serve you at any time command me.

Yours, very truly,

T. S. KYLE.

Capt. J. B. CAVANAUGH,
United States Engineer.

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SUBSEQUENT REPORT OF CAPT. J. B. CAVANAUGH, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Montgomery, Ala., November 22, 1904.

GENERAL: In connection with report upon the Alabama and Coosa rivers, submitted from this office June 30, 1904, in compliance with the requirements of the river and harbor act of June 13, 1902, I have the honor to submit the following * * * :

The present season has been one of extreme low water on all southern rivers, and the Alabama River has fallen below the lowest stages of record in this office. As the low-water discharge of the river has a direct bearing upon the proposed method of improvement by dredging and regulation, four measurements were made near Montgomery to determine the volume of this discharge, and the results found are as follows:

Discharge measurements of Alabama River.

Date.	Gauge heights at Montgomery.	Place of observation.	Discharge.	Remarks.
			Sec. ft.	
Oct. 25, 1904	−1.8	1 mile below Montgomery ...	2,158	Current meter, cable and boat, wind calm.
Do.....	−1.8	.....do	2,156	Do.
Oct. 26, 1904	−1.8	.....do	2,148	Do.
Nov. 10, 1904	−1.4	1¼ miles above Montgomery..	2,422	Current meter, cable, and boat, moderate wind.

These measurements indicate that the low-water discharge of the Alabama River is much smaller than expected, and that the statements made on page 8, et seq., of the above report in reference to the discharge of the river at lowest stages are in error, and the estimates as to the degree of improvement possible, based on the assumed discharge, are subject to revision.

The estimated period over which a 6-foot navigation could be maintained on the Alabama River is undoubtedly too long, and the improvement of the river which will result from the work covered by the estimate submitted will fall short of that stated in my report, for the plane of reference used in estimating the amount of dredging required was the water surface when the gauge at Montgomery reads zero, and during the present season the water has been below this zero for ninety days, and as low as −1.9, but in the absence of sufficient and accurate data it is practically impossible to predict the extent to which the river can be improved without resort to slack-water navigation, or to estimate closely the cost of improvement by dredging and regulation to the extent that is possible and advisable.

However, as the methods outlined and work provided for in the estimate already submitted are along the lines of those which will be required for the maximum possible improvement of the river for open-water navigation, and the local traffic of the Alabama is not sufficient to justify the improvement by locks and dams, the adoption of a project and estimate along the lines already submitted is recommended, as this will not only afford relief to the local traffic, but also enable sufficient data to be collected to make a safe prediction as to the ultimate

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possible improvement and the cost of securing the same, or of any lesser degree of improvement which the needs of commerce may require.

It is believed that the interests of the United States and the commerce on the Alabama River would be best served by providing for the improvement of this river under the continuing-contract system, and an estimate for this is as follows, the estimate previously submitted having been modified by omitting work required above Montgomery and providing for better dredges and commencement of active operations with present plant at once:

Removing 18,500 cubic yards of rock	$46,250
Construction of jetties and other works of regulation	150,000
Construction of two hydraulic dredges (estimated to require two years), at $75,000 each	150,000
Operation of these dredges for five years, at an average cost of $16,500 each per year	165,000
Operation of one snagboat for seven years	70,000
Surveys, superintendence, etc	68,750
Total	650,000

For maintenance after seventh year:

Operation of one snagboat per year	$10,000
Operation of dredging plant, per year	30,000
Superintendence and contingencies, including repairs to jetties	10,000
Total	50,000

Of this amount $125,000 should be made available for expenditure during fiscal year 1906 for plant, works of regulation, rock work, snagging operations, and dredge construction, and contracts to the extent of $150,000 should be authorized for the following year for completion of dredges and construction of regulating works. After the first two years an annual appropriation of $75,000 per year would be required for five years to operate the plant to its full capacity and complete the project.

It is believed that this work will give a 6-foot navigation at least nine months of the year and afford ample facilities for the local commerce of the Alabama all the year round.

In view of the fact that determined effort is being made to obtain authority to construct private dams for the purpose of utilizing the water powers of the Coosa River, it is recommended that a sufficient amount, estimated at $50,000, be made available for the thorough examination of all proposed lock and dam sites by boring and otherwise, for careful gauge observations, for discharge measurements, and for collecting such other data as may be necessary to thoroughly work out all the details of the proposed project, so that even if the improvement of the Coosa is not undertaken at present, any private dams which may be authorized can be located with reference to an approved project and constructed in harmony with the details of this project. The collection of this data will be of the greatest value to the improvement, for it will permit a more accurate revision of the estimate, with a possible reduction in cost, and will also provide for much work of investigation preliminary to actual construction, which for best results should extend over several years. The execution of this preliminary work, which costs comparatively little, will not only permit a more intel-

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ligent prosecution of the work when undertaken, but also permit the commencement of actual construction whenever money is made available.

With reference to the recommendation made that the improvement should not be undertaken unless it was done with a view to completion within less than ten years, I believe that by the construction of locks and dams at those sites where power would become immediately available for sale, and the improvement therefore of immediate benefit, the limiting period of construction might be somewhat extended.

Very respectfully, your obedient servant,

J. B. CAVANAUGH,
Captain, Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

REPORT OF THE BOARD OF ENGINEERS FOR RIVERS AND HARBORS.

THE BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., January 4, 1905.

GENERAL: In compliance with second indorsement, Office Chief of Engineers, dated July 12, 1904, the Board of Engineers for Rivers and Harbors has the honor to submit the following report on the improvement of the Coosa and Alabama rivers, of which a survey was ordered in the river and harbor act of June 13, 1902, as follows:

> Improving Coosa River, Georgia and Alabama, * * * And the Secretary of War shall cause a survey to be made of the Coosa and Alabama rivers with a view to determining the advisability of securing six-foot navigation in said rivers, and the probable expense thereof; the said survey shall also contain a report upon the advisability of further prosecuting the present project for locks and dams in the Coosa River. * * *

The Board has reviewed the accompanying report of the district officer on the survey, his preliminary report[a] on the same subject, with the related report[a] of the assistant engineer, and has considered the indorsements of the division engineer thereon. On November 14, 1904, a committee of the Board held a duly advertised public hearing at Montgomery, Ala., at which interested parties appeared and submitted arguments in favor of the improvement of these rivers. An inspection of a portion of the Coosa was made on the following day.

EXISTING PROJECTS.

The original project for the improvement of the Coosa River, undertaken by the State of Alabama as early as 1823, contemplated the opening of a continuous water route of transportation from the Mississippi River to the Atlantic Ocean, by way of the Ohio, Tennessee, Coosa, Etowah, Ocmulgee, and Altamaha rivers, and canals from the Tennessee to the Coosa and from the Etowah to the Ocmulgee. Data at hand do not show what was done under this project, but it is known that steamboats have been plying upon the upper Coosa for some forty years, and that a channel was partially cleared through the shoals in the lower river, on which flatboats carrying cotton were floated down to Mobile during high water.

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[a] Not printed.

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The Coosa River has, by acts of Congress making appropriations therefor, been divided into two sections—the upper and the lower. The upper section extends from Rome, Ga., to the East Tennessee, Virginia and Georgia Railroad bridge, a distance of about 236 miles, and the lower section from this bridge to Wetumka, a distance of 68 miles.

Various examinations and estimates for the improvement of the upper section of this river have been made from time to time, beginning in 1870, upon which Congress has made appropriations. The project as modified from time to time now provides for one lock and dam and open-river improvement from Rome, Ga., a distance of 162 miles to Greensport, Ala., and a further extension of the improvement 74 miles downstream to the East Tennessee, Virginia and Georgia Railroad bridge by 8 locks and dams. Locks 1, 2, and 3, commenced prior to 1890 and located, respectively, 0.68 mile, 3.86 miles, and 5.24 miles below Greensport, have been completed. Lock No. 4, which is situated 25.89 miles below Greensport, has been under construction since 1886, but is not completed. Nothing has been done at lock sites 5, 6, 7, and 8. Locks 1, 2, and 3 are 40 feet in width and 210 feet in length between miter sills. Locks 4 to 8, which are of a later design, have projected dimensions of 280 feet length, 52 feet width, and 6 feet depth over the miter sills. The total estimated cost of the original and modified projects in this section of the river is $1,496,107.23. * * *

The original project for the lower section of the river, adopted in 1890 and modified in 1892, contemplates an extension of the aforesaid slack-water navigation between Greensport and the East Tennessee, Virginia and Georgia Railroad bridge, a still further distance of 68 miles to Wetumka by the construction of 23 locks and dams of varying lifts up to 15 feet, and the removal of various rocks and reefs, so as to give a least navigable depth of 4 feet. The proposed dimensions of the locks are the same as for the projected Locks 4 to 8 in the upper section, viz, 280 feet length, 52 feet width, and 6 feet depth on the miter sills. Under this project the lowest lock in the series, known as Lock No. 31, has been constructed excepting the dam and gates, and the channel between this lock and the next proposed above has been excavated. The estimated cost of this project is $5,106,422. * * *

The Alabama River, formed by the junction of the Coosa and Tallapoosa rivers 11 miles below Wetumka, constitutes a 312-mile link in a waterway of 815 miles from the Oostenaula and Coosawattee rivers, Georgia, to the Gulf of Mexico. The original project for this river contemplated a channel depth of 4 feet and a width of 200 feet, which was to be secured by the removal of snags, logs, and other obstructions by constructing regulating works and by dredging; all at an estimated cost of $229,741. There has been expended on this project $185,000. The original project was modified in 1891 to provide for a 6-foot navigation, which was to be secured in the same general way as contemplated in the original project, at an estimated cost of $386,251, provided, however, that at least $100,000 should be appropriated annually and $10,000 a year thereafter for maintenance. There had been expended on this project to June 30, 1904, $225,552.67. The appropriations have not been sufficent to carry on the improvement to the best advantage, and during the last few years the channel has deteriorated. It is stated in the Annual Report of the Chief of Engi-

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neers for 1904 that the maximum draft that could be carried to Montgomery, Ala., was less than 3 feet in the low-water season.

COMMERCE.

The commerce of these streams is reported as follows:

Coosa River, between Rome and the East Tennessee, Virginia and Georgia Railroad bridge.

Year.	Tons.	Value.
1894	150,878	$1,620,000
1895	86,545	1,600,000
1896	54,613	1,800,000
1897	68,359	2,050,000
1898	66,936	2,000,000
1899	50,518	2,778,490
1900 a	33,776	2,000,000
1901 b	36,640	1,800,000
1903 c	77,760	1,975,548

a And 12,000,000 feet log rafts, valued at $60,000.
b And 3,000,000 feet log rafts, valued at $15,000.
c And 3,500,000 feet log rafts, valued at $17,500.

Three steamboats navigated this part of the river in 1903, being from 54 to 151 registered tons, draft light, 12 to 18 inches; loaded, 36 to 52 inches. One of these vessels plied between Rome and Gadsden and Locks 1, 2, and 3, and one between Carters, Ga., and Gadsden. The route of the other boat is not stated.

Coosa River, betweeen the East Tennessee, Virginia and Georgia railroad bridge and Wetumka.

The only commerce possible on this part of the Coosa River is the rafting of saw logs and square timber during the season when the river is about 12 feet above low water, but no reliable estimate of this commerce has been reported.

ALABAMA RIVER.

Year.	Tons.	Value.
1896 a	71,072	$6,400,000
1897 a	96,536	8,320,000
1898 a	97,176	8,400,000
1899 b	76,529	6,887,610
1900 c	85,567	7,701,030
1901 d	119,634	8,375,000
1902	114,087	8,375,000
1903	145,448	13,680,000
1904	133,492	13,317,000

a No record of logs and timber.
b And logs and timber valued at $2,500,000.
c And logs and timber valued at $3,000,000.
d And logs and timber valued at $3,500,000.

Six steamboats navigated the river in 1903, being from 209 to 320 registered tons; draft, light, 10 to 30 inches; loaded, 3 to 6 feet. One of these boats plied between Mobile and Montgomery, and five between Mobile and Selma.

Very large quantities of sawn and hewn timber, saw logs, cord wood, etc., consisting of yellow pine, sycamore, cottonwood, poplar, and ash, are barged and rafted down this stream to Mobile, Ala., but the amount of this business can not be accurately stated, as the statistics of the port of Mobile combine the receipts from this stream with those from the Tombigbee and other streams tributary to that port.

In general the commerce of the Coosa and Alabama rivers consists principally of cotton, cotton seed, fertilizer, grain, lumber, shingles, staves, naval stores, and general merchandise. The completed improve-

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ment was expected to induce the transportation by water of large quantities of coal, iron, and agricultural and manufactured products from the Coosa Valley, the total production of which in 1899 was estimated by the district officer at that time as having a valuation of $14,180,300.

INVESTIGATIONS CALLED FOR IN THE RIVER AND HARBOR ACT OF JUNE 13, 1902.

The questions now under consideration are, first, the advisability of securing 6-foot navigation in the Coosa and Alabama rivers and the probable expense thereof, and second, the advisability of further prosecuting the present project for locks and dams in the Coosa River. Based on a survey of the Coosa River from Wetumka to Lock 4, and on a reconnaisance of the Coosa from Wetumka to its junction with the Tallapoosa, and of the Alabama from this point to its mouth, the district officer submits a report and tentative project for securing a 6-foot navigation on these streams from Gadsden, Ala., to the mouth of the Alabama River. The project for the Coosa between Wetumka and Lock 4 provides for the construction of 15 locks and dams, the completion of Lock 4 and Dam (now numbered) 31, together with the necessary excavation to provide a channel between the locks not less than 7 feet deep and 150 feet wide on the bottom. This project, by a rearrangement of the pools and an increase in lift of the locks where the banks will permit, reduces the number of locks required under the present project by 11; the channel between the locks has been increased from 100 feet wide by 4 feet deep to 150 feet wide by 7 feet deep; the width of the locks has been increased from 52 to 56 feet. The estimated cost of this project is $8,960,706.

The report also includes an estimate of cost of extending the 6-foot navigation from Lock 4 to Gadsden, Ala., as this would be necessary to secure the maximum benefits from the improvement. This would require the enlargement of Locks 1, 2, and 3, and the elevation of dams at Locks 1, 2, 3, and 4, and extensive channel work, or in lieu of enlarging Lock 3 and of much of the channel work, a new Lock 3 at Lonnergans reef, and a canal from this lock to the upper pool of the present Lock 3. The cost of this extension is estimated at $1,064,000, which makes a total for the Coosa River above Wetumka of $10,024,706.

The district officer expresses the opinion that it is entirely feasible to secure a 6-foot navigation from Wetumka to Gadsden at these figures, and that it is advisable, provided appropriations are sufficiently liberal to permit the work to be carried on economically and advantageously so as to complete it within ten years.

The project proposed by the district officer for the Alabama River is to secure 6 feet depth by dredging, combined with works of regulation, the Government providing its own dredge.

The portion of the Coosa and Alabama rivers between Wetumka and Montgomery was not covered by a survey, and the amount of fall is not known. The district officer thinks it may be necessary to construct a lock of low lift below the mouth of the Tallapoosa River, and the estimated cost of such lock is included in the estimate for the Alabama River, which estimate amounts to $1,000,000, and $55,000 per annum for maintenance. As in the case of the Coosa, the district officer expresses the opinion that the improvement for a 6-foot navigation in the Alabama River is advisable provided sufficiently liberal appro-

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priations are made to complete the improvement within ten years, but unless this can be done, it is not considered advisable, and any small appropriations should be applied to the Alabama River below Montgomery. The district officer states further that the expenditure of small appropriations on the section between Wetumka and Lock 4, where practically no benefit can be derived from the improvement prior to its completion as a whole, is a waste of public funds.

With respect to the second question specified in the act, the district officer expresses the opinion that it is not considered advisable to prosecute the present adopted project for locks and dams in the Coosa River further than to complete Lock 4 and construct a dam at Lock site 5. In this opinion the division engineer concurs.

With regard to the improvement of the Coosa and Alabama rivers, with a view to securing 6-foot navigation, the division engineer states that there is nothing to show that if the Alabama River were improved to a navigable depth of 6 feet the commerce originating on the river would be greatly increased or freight rates materially reduced; that the facts presented do not justify the expenditure of anything like the sums represented in the estimates, and that he does not consider the improvement of the Coosa and Alabama rivers to secure 6-foot navigation as worthy of being undertaken by the General Government at the present time.

In an additional report,[a] dated November 22, 1904, the district officer states that as a result of observations recently taken during an extreme low stage to determine the low-water discharge of the Alabama River, it developed that the minimum discharge is only about 2,180 cubic feet per second, instead of 5,000 cubic feet, as reported heretofore, and that in view of this fact the estimated period over which a 6-foot navigation could be maintained on the Alabama River is undoubtedly too long, and that the improvement which will result from the work covered by the estimate submitted will fall short of that stated in his report. He therefore modified his proposed project for the Alabama River, as an independent improvement, by omitting the work above Montgomery, and providing for better dredges. His modified estimate for the Alabama River is $650,000, to be expended in seven years, and $50,000 per annum for maintenance thereafter.

The general plan of improvement proposed by the district officer provides practically for the improvement of the Coosa River by locks and dams from Greensport to Wetumka, giving 6-foot navigation, and the extension of this navigable depth through the Alabama River to Mobile by works of regulation and dredging. As stated by the district officer the practical value of any improvement of the Coosa River, from Gadsden to Wetumka, depends upon the existence of an improved channel in the Coosa and Alabama rivers, from Wetumka to the mouth of the Alabama River, which will afford facilities equal to or better than those above Wetumka, so that the route from Gadsden to the seaboard at Mobile may be complete. On the other hand, the value of an improved channel in the Alabama River will be dependent to a greater or less extent upon the improvement of the Coosa River in its lower reach. The estimated cost of providing a 6-foot navigation in the Coosa River, $10,024,706, while reasonable, considering the amount of work to be done, is, in the opinion of the Board, in excess of the

[a] See p. 1384.

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value of the probable benefits, as all the commerce on the lower stretch of the river is prospective in character.

As to the Alabama River the district officer in a late report estimates that, based on recent low-water measurements of discharge, the period during which 6-foot navigation can be secured by dredging and regulation works is nine months per year, instead of ten months as originally stated. In view of the experience already had in snagging and works of regulation, the Board is of the opinion that a 6-foot navigation in the Alabama River can not be secured for even this period each year without resort to canalization. While no estimate of cost of the necessary locks and dams is given, the Board concurs with the district officer in the opinion that the cost of canalization will be in excess of the probable benefits to commerce.

CONCLUSIONS.

For these reasons the Board believes that the improvement of the Coosa River, with a view to securing 6-foot navigation, is not worthy of being undertaken by the General Government at this time, and that it is not advisable to further prosecute the present project for locks and dams in this river. The dam at Lock 4 should be placed in a permanent and satisfactory condition with a view to the utilization of the improvement from Rome to this point. The cost of completing the dam at Lock 4, together with the fore bay of the lock, is estimated by the district officer at $108,500. The Board is of the opinion that the construction of the fore bay should be omitted and the dam completed with suitable abutment on the left bank of the river, at a cost which should be considerably less than the estimate for completion with the fore bay of the lock.

The Board also believes that the improvement of the Alabama River should be limited to the removal of snags and other obstructions and such construction and maintenance of works of regulation as may be practicable with a total expenditure of $25,000 annually.

Respectfully submitted.

D. W. LOCKWOOD,
Lieut. Col., Corps of Engineers.
R. L. HOXIE,
Lieut. Col., Corps of Engineers.
CHARLES W. KUTZ,
Captain, Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

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APPENDIX R.

IMPROVEMENT OF RIVERS AND HARBORS IN WESTERN ALABAMA AND EASTERN MISSISSIPPI.

REPORT OF MAJ. W. E. CRAIGHILL, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1905, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Harbor at Mobile, Alabama.
2. Mobile Bar, Alabama.
3. Black Warrior, Warrior, and Tombigbee rivers, Alabama and Mississippi.
4. Operating and care of locks and dams on Black Warrior River, Alabama.
5. Pascagoula River, Mississippi.
6. Pascagoula, Leaf, and Chickasahay rivers, Mississippi.
7. Horn Island Pass, Mississippi.
8. Harbor at Biloxi, Mississippi.
9. Channel from Gulfport to Ship Island Harbor, Mississippi.
10. Pearl River below Rockport, Mississippi.
11. Pearl River between Edinburg and Jackson, Mississippi.
12. Removing sunken vessels or craft obstructing or endangering navigation.

UNITED STATES ENGINEER OFFICE,
Mobile Ala., July 18, 1905.

GENERAL: I have the honor to forward herewith annual report for the fiscal year ending June 30, 1905, for the works of rivers and harbors under my charge.

Very respectfully, your obedient servant,

W. E. CRAIGHILL,
Major, Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

R 1.

IMPROVEMENT OF HARBOR AT MOBILE, ALABAMA

Accounts of earlier improvements at this locality are contained in the Annual Reports of the Chief of Engineers for 1896, page 1425; 1900, page 2161, and 1903, page 1237.

Under date of June 7, 1904, an allotment of $50,000 was made from the emergency river and harbor act of April 28, 1904, for the purpose

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of maintaining the ship channel in Mobile Harbor. Of this amount $47,500 was allotted for dredging work and $2,500 for the work of removing sunken obstructions from the channel.

During the past fiscal year available funds have been applied to the following operations:

(1) The maintenance of a 23-foot channel in Mobile River and Bay.

(2) The removal of sunken logs and similar obstructions from the channel in Mobile Harbor.

(3) Survey work and contingent operations.

(1) THE MAINTENANCE OF A 23-FOOT CHANNEL IN MOBILE RIVER AND BAY.

The last general contract for the formation of a 23-foot channel in Mobile Harbor was completed on November 11, 1903. Portions of the channel obtained under this contract subsequently shoaled, and with funds allotted from the emergency river and harbor act of April 28, 1904, a contract was entered into with Mr. Rittenhouse Moore, of Mobile, Ala., under date of November 12, 1904, for maintenance dredging in the Mobibe Harbor ship channel. This contract was approved by the Chief of Engineers on December 3, 1904, and operations under it were commenced on January 6, 1905. Under the specifications governing this work the contract was to have been completed on or before May 6, 1905, but delays having occurred in the prosecution of the work, an extension of the time limit was granted the contractor, and operations were not finally completed until June 6, 1905. Under this contract a total of 498,739 cubic yards of material, scow measurement, were removed from the channel, and cuts about 55 feet wide, with a least depth of 23 feet, and with an aggregate length of 43,798 feet, were formed in Mobile Bay between light-house beacons 8A and 4, 12, and 10A, and in Mobile River above One-Mile Creek. This work resulted in the removal of such shoals as were most troublesome to navigation and placed the ship channel in fair condition for use.

The total amount expended during the year on maintenance dredging work was $47,323.94.

The minimum depth in the ship channel on June 30, 1905, was about 22 feet.

(2) THE REMOVAL OF SUNKEN LOGS AND SIMILAR OBSTRUCTIONS FROM THE CHANNEL IN MOBILE HARBOR.

In December, 1904, the snag boat *Black Warrior* was engaged in removing sunken trees, logs, and timbers from the channel of Mobile River below Choctaw Point, while between March 1 and June 30, 1905, the snag boat *Demopolis* was engaged in similar work in Mobile River. As a result of these operations the channel has been kept free from dangerous obstructions. The cost of this work during the year, including repairs to the United States plant engaged on these operations, amounted to $4,241.85, of which amount $2,500 was allotted from the emergency river and harbor act of April 28, 1904.

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(3) SURVEY WORK AND CONTINGENT OPERATIONS.

Examinations and surveys of portions of the ship channel have been made during the year. The harbor-line survey for the port of Mobile was completed, repairs have been made to working plant, and office records have been compiled. The total cost of these operations during the year has amounted to $10,766.79.

GENERAL.

The river and harbor act of March 3, 1905, carried an appropriation of $200,000 for the improvement and maintenance of the Mobile Harbor ship channel, and ordered a survey for the purpose of compiling an estimate of the cost of deepening the existing channel to 27 feet at mean low water.

In accordance with the approved project for the expenditure of available funds, the sum of $40,000 has been allotted to the work of improvement, $147,500 to maintenance dredging, $10,000 to the work of removing sunken obstructions from the channel, and $2,500 to the cost of making the required survey. In conformity with this project, bids were requested under public advertisement dated June 16, 1905, for the performance of maintenance dredging work to the extent of about $50,000 in Mobile Bay below light-house beacon 14. It is expected to commence this work early in the coming fiscal year. The balance of available funds will be applied to works of improvement and maintenance, as the need of such work becomes apparent.

Money statements.

GENERAL IMPROVEMENT.

July 1, 1904, balance unexpended		$60,921.33
Amount appropriated by river and harbor act approved March 3, 1905		190,000.00
From sales of Government property		8.50
		250,929.83
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$10,766.79	
For maintenance of improvement	47,323.94	
		58,090.73
July 1, 1905, balance unexpended		192,839.10
July 1, 1905, outstanding liabilities		1,100.00
July 1, 1905, balance available		191,739.10
Amount (estimated) required for completion of existing project		560,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$300,000.00	
For maintenance of improvement	75,000.00	
		375,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

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REMOVING OBSTRUCTIONS.

July 1, 1904, balance unexpended	$3,868.31
Amount allotted from river and harbor act approved March 3, 1905	10,000.00
	13,868.31
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	4,241.85
July 1, 1905, balance unexpended	9,626.46
July 1, 1905, outstanding liabilities	600.00
July 1, 1905, balance available	9,026.46
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	12,000.00

APPROPRIATIONS.

May 20, 1826	$10,000.00	
March 2, 1829	20,000.00	
June 24, 1834	10,000.00	
March 3, 1835	17,997.60	
March 3, 1837	50,000.00	
July 7, 1838	50,000.00	
August 3, 1852	50,000.00	
		$207,997.60
March 3, 1857 (relief claim)		20,833.00
July 11, 1870	50,000.00	
March 3, 1871	50,000.00	
June 10, 1872	75,000.00	
March 3, 1873	100,000.00	
June 23, 1874	100,000.00	
March 3, 1875	26,000.00	
		401,000.00
June 18, 1878 (survey)	10,000.00	
March 3, 1879	100,000.00	
June 14, 1880	125,000.00	
March 3, 1881	100,000.00	
August 2, 1882	125,000.00	
July 3, 1884	200,000.00	
August 6, 1886	90,000.00	
		750,000.00
August 11, 1888	250,000.00	
September 19, 1890	350,000.00	
July 13, 1892	212,500.00	
March 3, 1893	500,000.00	
August 18, 1894	390,000.00	
March 2, 1895	291,300.00	
March 16, 1896	160,000.00	
June 3, 1896 (maintenance)	60,000.00	
June 4, 1897 (maintenance)	25,000.00	
July 1, 1898 (maintenance)	30,000.00	
		2,268,800.00
March 3, 1899	100,000.00	
June 6, 1900	500,000.00	
June 13, 1902	250,000.00	
March 3, 1903	200,000.00	
March 3, 1905	200,000.00	
		1,250,000.00
April 28, 1904 (maintenance; allotment)		50,000.00
June 30, 1905, from sales of Government property		1,025.50
Total		4,949,656.10

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COMMERCIAL STATISTICS.

Statistics furnished by the United States custom-house, Mobile, Ala., showing the business of the port of Mobile for the calendar year ending December 31, 1904.

Exports	$16,782,983.00
Imports (valuation at point of shipment)	4,378,767.00
Total	21,161,750.00
Customs receipts from all sources	58,085.75

Vessels entered and cleared, 1904.

Trade.	Entered.		Cleared.	
	Number.	Tons. [a]	Number.	Tons. [a]
Foreign	703	578,577	737	596,368
Coastwise	123	194,556	152	197,000
Total	826	773,133	889	793,368

[a] Registered net tons.

Foreign commerce.

The following statement concerning the foreign commerce of the port of Mobile for the calendar year ending December 31, 1904, has been compiled from the records of the United States custom-house and from the reports of shippers, consignees, and carriers:

EXPORTS.

Articles.	Quantity.	Value.	Articles.	Quantity.	Value.
	Tons.			*Tons.*	
Breadstuffs	55,059	$2,082,150	Live stock	2,801	$333,636
Coal and coke	10,944	36,320	Naval stores	5,565	127,819
Cotton and cotton products	35,330	7,549,780	Staves	19,284	116,261
Hog products	10,462	1,402,740	Miscellaneous	52,326	523,264
Lumber	228,675	2,056,580			
Timber	192,666	1,567,662	Total	711,739	16,782,983
Manufactured goods	98,677	986,771			

IMPORTS.

Bananas	106,159	$2,653,986	Manganese ore	19,841	$120,520
Cocoanuts	3,726	124,200	Creosote oil	1,795	18,393
Sisal grass	16,839	2,862,630	Miscellaneous	29,968	299,677
Hard wood	4,015	80,300			
Sulphur ore	7,635	21,760	Total	189,978	[a] 6,181,466

[a] Valuation at point of receipt.

Bunker coal furnished outward-bound steamships, 208,380 tons, valued at $625,140.

The following lines of steamships operate between Mobile, Ala., and foreign ports: United Fruit Company, Central American ports; Orr-Laubenheimer Steamship Company, Central American ports; Camors-McConnell Steamship Company, Central American ports; John B. Cefalu & Co., Central American ports; Thacker Brothers, Central American ports; Munson Line, Cuban ports; Atlantic and Mexican Gulf Steamship Company, Mexican ports; Benemelis Line, Mexican ports; Elder-Dempster Company, United Kingdom and Continent; Percy Line, Cuban ports.

The following lines of steamships operate between Mobile, Ala., and coastwise ports: Mallory Line, Brunswick, Ga., and New York; Pensacola, St. Andrews and Gulf Steamship Company, Florida ports; McKay Steamship Line, Tampa, Fla.

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Coastwise commerce for the calendar year 1904.

ARRIVING.

Articles.	Quantity.	Value.	Articles.	Quantity.	Value.
	Tons.			*Tons.*	
Phosphate	12,300	$104,500	Fish and oysters	11,520	$514,393
Anthracite coal	1,450	8,700	Merchandise, general	61,641	4,768,773
Dynamite and powder	300	28,200	Cement	6,584	28,275
Cord wood	7,872	18,450			
Naval stores	5,700	253,000	Total	125,117	5,884,291
Staves	20,800	160,000			

DEPARTING.

Cotton	14,463	$3,181,805	Rosin	5,200	$150,000
Lumber	24,570	426,210	Miscellaneous	28,300	3,398,664
Cross-ties	4,958	21,674			
Grain and hay	16,045	400,595	Total	104,174	7,668,307
Timber	10,638	89,359			

In addition to the above, water shipments to and from Alabama and Tombigbee river points, consisting of cotton, cotton seed, logs, provisions, feed, machinery, farm supplies, and manufactured goods, amounted in 1904 to 650,000 tons, valued at $13,000,000.

Comparative statement of the number and draft of vessels passing up and down the dredged channel for the calendar years ending December 31, 1903 and 1904.

[Compiled from the books of the harbormaster at Mobile, Ala.]

Draft.	Steamships.				Square-rigged vessels.			
	Up.		Down.		Up.		Down.	
	1903.	1904.	1903.	1904.	1903.	1904.	1903.	1904.
Less than 13 feet	484	381	306	280	37	44	4	.....
13 to 14 feet	107	103	109	82	14	15	2	.....
14 to 15 feet	77	83	82	63	8	11	14	5
15 to 16 feet	28	57	46	42	4	4	3	8
16 to 17 feet	11	15	26	25	.....	.....	1	8
17 to 18 feet	3	9	25	37	2	.....	5	8
18 to 19 feet	6	5	34	38	1	1	12	3
19 to 20 feet	1	4	28	27	3	.....	6	14
20 to 21 feet	6	4	17	25	2	.....	9	13
21 to 22 feet	1	2	35	17	1	.....	10	10
22 to 23 feet	1	.....	17	27	.....	1	6	7
Total	725	663	725	663	72	76	72	76

Draft.	Schooners.				Total.			
	Up.		Down.		Up.		Down.	
	1903.	1904.	1903.	1904.	1903.	1904.	1903.	1904.
Less than 13 feet	120	171	85	100	641	596	395	380
13 to 14 feet	3	1	18	21	124	119	129	103
14 to 15 feet	1	3	16	32	86	97	112	100
15 to 16 feet	.....	.....	3	13	32	61	52	63
16 to 17 feet	2	2	3	7	13	17	30	40
17 to 18 feet	.....	.....	1	3	5	9	31	48
18 to 19 feet	1	.....	2	.....	8	6	48	41
19 to 20 feet	.....	.....	.....	2	4	4	34	43
20 to 21 feet	1	2	.....	.....	9	6	26	38
21 to 22 feet	.....	.....	.....	.....	2	2	45	27
22 to 23 feet	.....	.....	.....	1	1	1	23	35
Total	128	179	128	179	925	918	925	918

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R 2.

IMPROVEMENT OF MOBILE BAR, ALABAMA.

This work was first provided for in the river and harbor act of June 13, 1902, and originally formed a part of the project for improving harbor at Mobile, Ala. The river and harbor act of March 3, 1905, however, made a separate project of the Mobile bar work and increased the limit of cost of this improvement from $91,250 to $100,000.

An account of the work accomplished at this locality up to the close of the fiscal year ending June 30, 1904, is contained in the Annual Report of the Chief of Engineers for 1904, page 1805.

At the beginning of the past fiscal year dredging operations on Mobile bar were in progress under a contract with Mr. Rittenhouse Moore of Mobile, Ala., dated August 22, 1903, and approved October 20, 1903. Work under this contract was in progress until July 20, 1904, when operations thereunder were completed. Between July 1, and 20, 1904, the material removed from the Mobile bar channel amounted to 43,697 cubic yards, bin measurement, making a total of 144,130 cubic yards removed under this contract. The price paid was 30 cents per cubic yard, bin measurement. This work resulted in the formation of a channel with a least depth of 27 feet, and with a width of about 225 or 250 feet through Mobile bar. The bar has a total length between the 30 foot curves of depth, of about 3,500 feet.

Since the completion of work under the above contract the channel has shoaled somewhat, and on June 30, 1905, there was a least depth of about 25½ feet on the light-house range through the dredged cut.

On June 15, 1905, proposals for deepening and widening the existing channel through Mobile bar, to its projected dimensions, 30 feet deep and 300 feet wide, were opened. Only one bid, that of the Southern Dredging Company, of Mobile, Ala., at the price of 30 cents per cubic yard, bin measurement, was received. The acceptance of this bid has been authorized.

During the coming fiscal year it is proposed to apply the appropriation of $50,000 carried by the river and harbor act of March 3, 1905, for this improvement to the work of maintaining the existing cut and deepening the channel to the projected depth of 30 feet over a portion of the width. The work of maintenance is estimated to cost about $25,000.

During the past fiscal year expenditures amounted to $23,585.49 for dredging and contingent expenses, and about one-third of the work to be accomplished at this locality has been completed.

As stated in the Annual Report for 1903, the effective maintenance of the channel through Mobile bar can only be accomplished with Government plant. It is therefore recommended that, in future appropriations for this locality and for the other sea bars in this district, provision be made for the construction of a small sea-going hydraulic dredge, for the performance of such work.

For commercial statistics, see report on harbor at Mobile, Ala., foreign and coastwise commerce.

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Money statement.

July 1, 1904, balance unexpended		$26,592.09
Amount appropriated by river and harbor act approved March 3, 1905		50,000.00
		76,592.09
June 30, 1905, amount expended during fiscal year, for works of improvement		23,585.49
July 1, 1905, balance unexpended		53,006.60
July 1, 1905, outstanding liabilities		50.00
July 1, 1905, balance available		52,956.60
Amount (estimated) required for completion of existing project		25,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$25,000.00	
For maintenance of improvement	30,000.00	
		55,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

APPROPRIATIONS.

June 13, 1902	$50,000
March 3, 1905	50,000
Total	100,000

R 3.

IMPROVEMENT OF BLACK WARRIOR, WARRIOR, AND TOMBIGBEE RIVERS, ALABAMA AND MISSISSIPPI.

PROJECT FOR BLACK WARRIOR, WARRIOR, AND TOMBIGBEE RIVERS, ALABAMA.

To afford a channel for 6-foot navigation from the junction of the Mulberry and Locust forks of the Black Warrior River to the mouth of the Tombigbee River, a distance of 362 miles, by the construction of locks and dams and other necessary work. Locks are to be 52 feet wide and 322 feet between gates, giving an available length of 285 feet; minimum depth of water on miter sills, 6½ feet, and 7 feet in lock chambers and approaches.

(A) BLACK WARRIOR RIVER.

[Above Tuscaloosa, Ala.]

The following work was done by the contractors at Lock 13 (formerly known as Lock 4) during the year:

Rubble masonry	cubic yards	636
Excavation	do	71
Rock excavation	do	320
Embankment	do	643
Paving	do	10
Riprap hand placed	do	248
Bolt holes in masonry	linear feet	337
Framed timber	feet B. M.	774
Grubbing and clearing, complete	per cent	10

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Contract work, being complete, was accepted in May, 1905.

The lock gates were erected, 296 cubic yards stone placed for extending riprap bank protection, and some grading done by hired labor during May and June, 1905.

PRESENT CONDITION OF WORK.

Three locks completed, the fourth lock ready for navigation, though some minor parts have not been finished, and 7 locks not yet begun; survey for 2 of these locks completed.

PROPOSED APPLICATION OF FUNDS.

With available funds it is proposed to complete work on Lock and Dam No. 13, and with future appropriations to carry the work of lock and dam construction on up the river.

NAVIGATION AND COMMERCE.

The bulk of the traffic on this part of the river passes through Locks 10, 11, and 12, and is given in detail in the report on operating and care of locks and dams, Black Warrior River, Alabama. In addition to this there is a small traffic in coal and timber on the pool above Lock 12, statistics of which are not available.

(B) WARRIOR RIVER.

[Below Tuscaloosa, Ala.]

WORK OF THE PAST YEAR.

Work on Locks 1, 2, and 3, which was commenced in May, 1903, under contract with M. T. Lewman & Co., of Louisville, Ky., dated April 1, 1903, and approved April 22, 1903, was continued until December 31, 1904, when contractors abandoned the work, which was about 26 per cent completed, and removed a large part of the plant which had been used on construction work.

During February, 1905, the completion of these locks by hired labor was authorized, and since that time plant and material have been purchased and delivered and work resumed at all three of the locks. During the past fiscal year the following was accomplished by contract and hired labor:

	Lock 1.	Lock 2.	Lock 3.
Grubbing and clearing.....acre..	1		
Excavated material.....cubic yards..	46,265	24,483	29,885
Concrete.....do....	5,700	1,093	904
Gravel filling.....do....	22	353	
Miter sills.....feet B. M..		346	696
Cofferdam timber.....do....	446	65,533	
Framed timber.....do....			1,026
Sheathing.....do....	6,146		354
Sheathing taken out and used again.....do....	1,482		
Sheet piling.....do....	1,704		148,881
Foundation piles delivered.....linear feet..	617	702	19,371
Foundation piles driven.....do....	64	132	28,056
Drain pipe.....do....	100		
Placing valves and special irons.....pounds..	38,452	257	1,257
Stone filling delivered.....cubic yards..	731	1,862	3,372

On June 30, 1904, work on these three locks was about 30 per cent completed.

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LOCK GATES.

Material for the construction of the gates for Locks 1, 2, and 3 was purchased and delivered at the Tuscaloosa shops during the previous fiscal year. These gates have been built by hired labor and are stored at the Tuscaloosa shops ready for erection.

MAINTENANCE.

No work of maintenance was carried on during the past year. Considerable dredging is needed at the upper end of each pool and several slip-ins, caused by high water during the past winter, should be removed.

PRESENT CONDITION OF WORK.

Three locks have been completed and are in operation, and three locks begun under contract are now being built with hired labor.

PROPOSED APPLICATION OF FUNDS.

With available funds and additional appropriations it is proposed to complete Locks 1, 2, and 3, construct and equip a telephone line, build and operate a dredge, and erect additional lock houses.

NAVIGATION AND COMMERCE.

A portion of the traffic on this stream passed Locks 7, 8, and 9, and is given in detail in the report on operating and care of locks and dams, Black Warrior River, Alabama. In addition to this there was some navigation and rafting on the river below Lock 7, statistics for which are not available.

(c) TOMBIGBEE RIVER.

WORK OF THE PAST YEAR.

Operations were largely confined to making additional survey for location of Locks 2 and 3, preparation of plans and specifications for completing Lock 1 and constructing Lock 2, and the advertisement of the work at Lock 1.

PRESENT CONDITION OF WORK.

One lock is about two-thirds completed, and two locks and the work of dredging have not yet been commenced. The survey has been completed.

For commercial statistics for the calendar year ending December 31, 1903, see report on Tombigbee River, mouth to Demopolis.

Money statement.

BLACK WARRIOR RIVER—GENERAL PROJECT.

July 1, 1904, balance unexpended	$26,063.14
From sales of Government property	18.50
	26,081.64

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June 30, 1905, amount expended during fiscal year, for works of improvement	$16,375.17
July 1, 1905, balance unexpended	9,706.47
July 1, 1905, outstanding liabilities	2,009.00
July 1, 1905, balance available	7,697.47
Amount (estimated) required for completion of existing project	Indefinite.
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	250,000.00

BLACK WARRIOR RIVER—SURVEY.

July 1, 1904, balance unexpended	$586.42
July 1, 1905, balance unexpended	586.42

WARRIOR RIVER—GENERAL PROJECT.

July 1, 1904, balance unexpended	$602,829.53
Amount diverted during fiscal year, Tombigbee River survey	5,000.00
	597,829.53
Amount allotted from river and harbor act approved March 3, 1905	7,500.00
Amount appropriated by sundry civil act approved March 3, 1905	15,000.00
Amount received from sales of Government property	249.79
	620,579.32
June 30, 1905, amount expended during fiscal year, for works of improvement	196,342.03
July 1, 1905, balance unexpended	424,237.29
July 1, 1905, outstanding liabilities	75,000.00
July 1, 1905, balance available	349,237.29
July 1, 1905, amount covered by uncompleted contracts	55,700.00
Amount (estimated) required for completion of existing project	[a] 146,966.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	146,966.00

WARRIOR RIVER, TUSCALOOSA TO DEMOPOLIS—MAINTENANCE.

July 1, 1904, balance unexpended	$2,691.95
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	947.85
July 1, 1905, balance unexpended	1,744.10
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	10,000.00

[a] Balance necessary to complete appropriations to the amount of $1,534,000, original estimated cost of Warrior River project $60,000
Balance of additional amount provided by the river and harbor act of March 3, 1905, for completion of Warrior River project 86,966
Total 146,966

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TOMBIGBEE RIVER, ALABAMA—SURVEY.

July 1, 1904, balance unexpended	$43.43
Allotted from appropriations for Warrior River	5,000.00
	5,043.43
June 30, 1905, amount expended during fiscal year, for works of improvement	3,897.96
July 1, 1905, balance unexpended	1,145.47

TOMBIGBEE RIVER, MOUTH TO DEMOPOLIS, GENERAL PROJECT.

July 1, 1904, balance unexpended	$13.00
Amount allotted from river and harbor act approved March 3, 1905	79,000.00
	79,013.00
June 30, 1905, amount expended during fiscal year, for works of improvement	78.00
July 1, 1905, balance unexpended	78,935.00
July 1, 1905, outstanding liabilities	126.00
July 1, 1905, balance available	78,809.00
Amount (estimated) required for completion of existing project	1,121,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	400,000.00

CONSTRUCTION OF DREDGE.

Amount allotted from river and harbor act approved March 3, 1905	3,500.00
July 1, 1905, balance unexpended	3,500.00
Amount (estimated) required for completion of existing project	36,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	36,500.00

CONSTRUCTION OF LOCK HOUSES.

Amount allotted from river and harbor act approved March 3, 1905	10,000.00
July 1, 1905, balance unexpended	10,000.00
Amount (estimated) required for completion of existing project	20,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	20,000.00

APPROPRIATIONS.

Black Warrior River.

July 5, 1884	$50,000.00
August 1, 1886	56,250.00
August 11, 1888	100,000.00
September 19, 1890	150,000.00

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July 13, 1892	$200,000.00	
August 18, 1894	37,500.00	
June 3, 1896	10,000.00	
March 3, 1899	50,000.00	
June 6, 1900	86,824.00	
March 3, 1901	53,676.00	
Amount transferred from Warrior River appropriation by act of June 13, 1902	14,000.00	
	808,250.00	
June 30, 1905, from sales Government property	201.92	
		$808,451.92

Warrior and Tombigbee rivers.

March 3, 1875	25,000.00	
August 14, 1876	15,000.00	
June 18, 1878	28,000.00	
March 3, 1879	20,000.00	
		88,000.00

Warrior River.

PREVIOUS PROJECTS.

June 14, 1880	20,000.00	
March 3, 1881	10,622.00	
August 2, 1882	10,000.00	
July 5, 1884	12,000.00	
August 5, 1886	18,750.00	
August 11, 1888	18,000.00	
September 19, 1890	45,000.00	
July 13, 1892	75,000.00	
August 18, 1894	40,000.00	
June 3, 1896	70,000.00	
		319,372.00

EXISTING PROJECT.

March 3, 1899		220,000.00	
June 6, 1900		200,000.00	
June 6, 1900 (emergency act—allotted)		3,691.24	
March 3, 1901		240,000.00	
June 13, 1902		374,000.00	
March 3, 1903		200,000.00	
April 28, 1904		225,000.00	
March 3, 1905		15,000.00	
March 3, 1905 (allotment)		7,500.00	
		1,485,191.24	
Less amount transferred to Black Warrior River by act of June 13, 1902	$14,000.00		
Amount diverted for survey for location of lock sites in Tombigbee River, as authorized by act of June 13, 1902	13,000.00		
		27,000.00	
		1,458,191.24	
June 30, 1905, from sales Government property		456.61	
			1,458,647.85

Tombigbee River.

June 13, 1892	[a] $50,000.00
August 18, 1894	[a] 50,000.00
June 3, 1896	[a] 50,000.00
March 3, 1899	50,000.00

[a] Portions of Tombigbee River appropriation applied to work of lock and dam construction.

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March 3, 1905 (including amounts for dredge and lock-houses)	$92,500.00	
Amount diverted from Warrior River appropriation for survey for location of lock sites, as directed by act of June 13, 1902	13,000.00	
	305,500.00	
June 30, 1905, from sales of Government property	175.00	
		$305,675.00
Total		2,980,146.77

CONTRACTS IN FORCE.

With P. H. O'Brien, dated April 20, 1905 (emergency contract), for excavation work and hire of teams and outfits, in connection with the construction of Locks and Dams Nos. 1, 2, and 3, Warrior and Tombigbee rivers, Ala., at the rate of 30 cents per cubic yard for excavation measured in place; or, $4 per day for each team and outfit used for hauling or other purpose; or, $4.50 per day each for from 12 to 20 or more two-horse or two-mule teams, complete with harness, wheel scrapers, plows, drivers, loaders, dumpers, plowmen, and a competent foreman, for excavation work; or, $4.25 per day each for from 12 to 20 or more teams, complete with harness, drivers, and one competent foreman, for scraper work, the United States to furnish and maintain scrapers and plows. Work commenced May 18, 1905; to be completed January 1, 1906.

With Southeastern Lime and Cement Company, dated April 26, 1905 (emergency contract), for furnishing and delivering f. o. b. Demopolis, Ala., 7,500 barrels of "Red Diamond" Portland cement at the rate of $1.45 per barrel. Delivery of cement to commence within ten days after signature of contract, at a rate not to exceed 2,500 barrels per month, and to be completed by August 1, 1905.

With W. K. Saulsbury, dated May 26, 1905 (emergency contract), for furnishing and delivering 16,000 tons stone at abutment site for Lock No. 1, on the Tombigbee River near Demopolis, Ala., at the rate of $1.75 per ton of 2,000 pounds. Delivery of stone to commence by July 1, 1905, and to be completed by December 31, 1905.

(D) TOMBIGBEE RIVER, MOUTH TO DEMOPOLIS.

The existing project for this improvement as modified by the river and harbor act of June 13, 1902, provides for the maintenance of the channel obtained under earlier appropriations, between the mouth of the Tombigbee River and Demopolis, a distance of 185 miles, by the removal of obstructions from the channel, the cutting of overhanging trees on the banks, and the repair of dikes.

Under date of May 31, 1904, an allotment of $4,000 from the contingent appropriation of the river and harbor act of June 13, 1902, was made for emergency work in the Tombigbee River, mouth to Demopolis. During the past fiscal year, with these funds, slight repairs were made to the snag boat *Black Warrior*, and operations on the river were commenced on September 17, 1904. Various obstructions were removed from the river between its mouth and Osage bar, 139½ miles above Mobile, the channel at Peaveys shoals was improved and deepened by the removal of sunken logs which had caused the formation of shoals, and jetty work was performed on the Osage bar dike, in order to make that structure, which had suffered considerable damage by washouts, effective in concentrating the river currents over the bar at that locality. Work on the river was completed

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December 31, 1904. The cost of these operations amounted to $3,776.31, and the balance of the allotment, $223.69, was turned back into the United States Treasury.

Additional expenditures during the year, amounting to $111.61, have been for the preservation and care of public property.

The river and harbor act of March 3, 1905, appropriated $15,000 for maintenance work on this section of the Tombigbee River. It is proposed to apply these funds to the work of maintaining a navigable channel within the limits of the improvement, by snagging work, repairing dikes, and removing shoals in dredged cuts.

This improvement is not permanent owing to the obstructions which are brought into the channel during the high-water stages, and future appropriations will therefore be applied to a continuation of the work of maintenance.

Under existing projects no provision is made for snagging work from the junction of the Tombigbee and Alabama rivers down to Chickasaw Creek, the northern limit of the Mobile Harbor project. Dangerous obstructions are sometimes carried into this section of the river, and the removal of these obstructions is considered important.

Money statement.

July 1, 1904, balance unexpended		$4,305.85
Amount appropriated by river and harbor act approved March 3, 1905		15,000.00
		19,305.85
June 30, 1905, amount expended during fiscal year:		
Amount turned back into Treasury	$223.69	
For maintenance of improvement	3,887.92	
		4,111.61
July 1, 1905, balance unexpended		15,194.24
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905		30,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

APPROPRIATIONS.

Previous projects.

June 10, 1872	$5,332.95	
June 14, 1880 (below Vienna)	15,000.00	
March 3, 1881 (below Vienna)	7,988.00	
August 2, 1882 (below Vienna)	12,500.00	
July 5, 1884 (below Vienna)	15,000.00	
August 5, 1886 (below Vienna)	11,250.00	
August 11, 1888 (below Vienna)	6,000.00	
September 19, 1890	55,000.00	
July 13, 1892	[a] 75,000.00	
August 18, 1894	[a] 25,000.00	
June 3, 1898	[a] 25,000.00	
Allotted from emergency act June 6, 1900	3,980.81	
		$257,051.76

[a] Portions of Tombigbee River appropriations applied to snagging work.

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Existing project.

June 13, 1902 (allotment)	$16,000.00	
Allotted from act of June 13, 1902	3,776.31	
March 3, 1905	15,000.00	
		$34,776.31
June 30, 1905, from sales of Government property		72.69
Total		291,900.76

COMMERCIAL STATISTICS.

Commerce on the Tombigbee River, mouth to Demopolis, during the calendar year ending December 31, 1904, consisted of cotton, cotton seed, logs, timber, breadstuffs, fertilizers, farm supplies, provisions, and general merchandise. The amount of this commerce was about 250,000 tons, valued at about $4,750,000.

(E) DEMOPOLIS TO COLUMBUS.

Owing to lack of funds, no work in connection with this improvement was in progress between December 26, 1903, and June 26, 1905.

The river and harbor act of March 3, 1905, appropriated the sum of $10,000 for maintenance work on the Tombigbee River, Demopolis to Columbus, and with funds thus appropriated, working property was purchased, the snagboat *Vienna* was towed from Mobile to Demopolis after undergoing repair, and snagging work was commenced at the latter locality on June 26. During the balance of the month a distance of 3½ miles of river was worked over.

Available funds will be applied to the prosecution of this work during the coming year, and future appropriations will be applied to a continuation of the same operations, as the work performed is not permanent in its nature, every rise of the stream causing new obstructions to lodge in the channel.

The river and harbor act of March 3, 1905, provided for an examination of the "Tombigbee River from Demopolis, Alabama, to Columbus, Mississippi, with a view to securing a continuous channel four feet deep." It is proposed to make this examination early in the coming fiscal year.

Money statement.

July 1, 1904, balance unexpended		$123.59
Amount allotted from river and harbor act approved March 3, 1905		10,000.00
		10,123.59
June 30, 1905, amount expended during fiscal year, for maintenance of improvement		555.57
July 1, 1905, balance unexpended		9,568.02
July 1, 1905, outstanding liabilities		680.00
July 1, 1905, balance available		8,888.02
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		20,000.00

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APPROPRIATIONS.

June 14, 1880 (Columbus to Vienna)	$12,000	September 19, 1890	$15,000
March 3, 1881 (Columbus to Vienna)	6,390	July 13, 1892	35,000
August 2, 1882 (Vienna to Fulton)	7,500	August 18, 1894	50,000
July 5, 1884 (Vienna to Fulton)	10,000	June 3, 1896	50,000
August 5, 1886 (Vienna to Fulton)	7,500	March 3, 1899	10,000
August 11, 1888 (Vienna to Fulton)	6,500	March 3, 1905 (allotment)	10,000
		Total	219,890

COMMERCIAL STATISTICS.

Commerce on the Tombigbee River from Demopolis to Columbus during the calendar year ending December 31, 1904, consisted of cotton, cotton seed, logs, breadstuffs, fertilizers, farm supplies, provisions, and general merchandise. The amount of this commerce was about 20,000 tons, valued at about $600,000.

(F) COLUMBUS TO WALKERS BRIDGE.

Owing to lack of funds no operations were in progress on the Tombigbee River between Columbus and Walkers Bridge between December 5, 1903, and June 1, 1905.

In accordance with the provisions of the river and harbor act of March 3, 1905, an allotment of $2,000 from the appropriation for Tombigbee River, Demopolis to Columbus, was made for the section of the stream between Columbus and Walkers Bridge.

During the past fiscal year working property was purchased, a snagging party was organized, and operations on the stream were commenced on June 16, 1905. During the balance of the month a distance of 2 miles of river was worked over and restored to its improved condition. Expenditures during the year have amounted to $523.86.

It is proposed to continue snagging operations during the coming fiscal year with funds now available, and to apply future appropriations, if made, to a continuance of the work of maintaining a navigable high-water channel within the limits of this improvement.

This section of the Tombigbee River is not considered worthy of further improvement by the United States, owing to the small amount of commerce using it and owing to the small number of persons benefited by the improvement.

Money statement.

July 1, 1904, balance unexpended	$327.98
Amount allotted from river and harbor act approved March 3, 1905	2,000.00
	2,327.98
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	523.86
July 1, 1905, balance unexpended	1,804.12
July 1, 1905, outstanding liabilities	520.00
July 1, 1905, balance available	1,284.12

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APPROPRIATIONS.

For Tombigbee River above Columbus:		
June 10, 1872	$4,667.05	
June 18, 1878	12,000.00	
March 3, 1879	10,000.00	
March 14, 1880	4,000.00	
March 3, 1881	1,000.00	
		$31,667.05
For Tombigbee River, Fulton to Columbus:		
July 13, 1892	6,000.00	
August 18, 1894	4,000.00	
June 3, 1896	8,000.00	
March 3, 1899	5,000.00	
		23,000.00
For Tombigbee River, Walkers Bridge to Fulton:		
August 11, 1888	4,000.00	
September 19, 1890	4,000.00	
July 13, 1892 (maintenance)	3,000.00	
August 18, 1894 (maintenance)	1,000.00	
June 3, 1896 (maintenance)	1,000.00	
March 3, 1899 (maintenance)	1,000.00	
		14,000.00
For Tombigbee River, Columbus to Walkers Bridge:		
June 13, 1902 (allotment)	4,000.00	
March 3, 1905 (allotment)	2,000.00	
		6,000.00
Total		74,667.05

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR ENDING DECEMBER 31, 1904.

Logs and timber:		
Quantity	tons	135,000
Value		$300,000

R 4.

OPERATING AND CARE OF LOCKS AND DAMS ON BLACK WARRIOR RIVER, ALABAMA.

LOCKS 7, 8, 9, 10, 11, AND 12, BLACK WARRIOR RIVER, ALABAMA.

GENERAL CONDITION OF LOCKS.

Lock 7 was completed and opened for traffic in November, 1903; Lock 8 opened for traffic in October, 1903, and Lock 9 has been in operation since October, 1902. These locks are in fair condition, though additional riprap for bank protection and additional stone filling below dams are needed to check erosion. Timber guide cribs filled with stone are needed to replace pile clusters above these locks. Locks 10, 11, and 12 were completed and opened for traffic in November, 1895, and are in fair condition, except wooden miter posts, which should be renewed.

WORK OF PAST YEAR.

Lock 7 (formerly Lock 4, Warrior River).—Stone filling has been placed below apron of dam, along face of abutment, and along river wall of lock to check erosion. Riprap bank protection has been repaired and extended; 2,318 tons stone filling and 910 tons of quarry waste have thus been used since July 1, 1904. Minor repairs made to

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valves, paving, ditches, and camp houses. Flood deposit has been removed from lock chamber and some dredging done in lower approach to lock.

Lock 8 (formerly Lock 5, Warrior River).—At this lock considerable erosion had taken place below dam, and leakage through floor had increased to such an extent during October, 1904, as to interfere with the operation of the lock. Plant and material were assembled, levee of dredged material built around lower end and river wall of lock, lock chamber pumped out, floor repaired, and gates and valves painted, lock having been closed to navigation for twenty-six days The deeper holes below dam were filled with gravel filling, with a heavy covering of stone filling, and additional derrick stones were placed on apron below dam, increasing width of same from 15 to 35 feet. Sand filled above dam and protected with covering of quarry waste; 501 tons sand, 4,876 tons gravel filling, and 5,829 tons stone and quarry waste used in this work since July 1, 1904.

Lock 9 (formerly Lock 6, Warrior River).—Gravel filling placed in deep holes which had been eroded below dam, stone filling and derrick stones placed below dam and quarry waste used for filling above dam, repairing riprap slopes, and filling along river wall of lock; 3,363 tons of gravel filling and 2,874 tons of stone and quarry waste used in this work since July 1, 1904. About 4,500 cubic yards flood deposit and gravel dredged from lower approach to lock and channel below it.

Locks 10, 11, and 12 (formerly Locks 1, 2, and 3).—Painting and repairs to gates and valves, which work was begun in June, 1904, completed; 1,050 barrels cement purchased; sand and gravel dredged and delivered; area between wing walls of these three locks graded and covered with concrete paving. Nine hundred and thirty-nine cubic yards, or 6,637 square yards, of paving were placed. Seven hundred and ninety-one tons stone delivered and placed for extending riprap bank protection.

About 12,722 tons of stone and quarry waste have been quarried near Tuscaloosa and towed to the six locks. Some dredging has been done below Lock 10 and repairs made to plant.

Statement of expenditures for operating and caring for Locks 7, 8, 9, 10, 11, and 12, Black Warrior River, Alabama, during the fiscal year ending June 30, 1905.

[Submitted in accordance with Circular No. 12, Office Chief of Engineers, dated July 31, 1897.]

Items.	Allotted.	Expended.	Balance.	Minus balance.
Salaries junior engineer, lockmaster, and lockmen	$10,080.00	$7,145.34	$2,934.66	.....
Extra labor	1,500.00	1,527.13	.....	$27.13
Riprap bank protection	8,200.00	3,716.85	4,483.15	.....
Stone paving below dams	6,000.00	2,453.60	3,546.40	.....
Gravel filling below dams	5,000.00	1,352.63	3,647.37	.....
Stone filling below dams	10,000.00	13,648.85	.....	3,648.85
Removing flood deposits from locks and approaches	3,000.00	1,186.74	1,813.26	.....
Filling above dams	1,000.00	1,004.58	.....	4.58
Painting gates and valves	2,000.00	1,400.76	599.24	.....
800 barrels of cement	2,000.00	1,286.06	713.94	.....
Concrete paving and repairs to masonry at Locks 10, 11, and 12	3,600.00	6,692.55	.....	3,092.55
Tools and plant	2,000.00	2,037.58	.....	37.58
Fuel, lights, and oil	1,000.00	1,282.73	.....	282.73
Telephone service and maintenance	500.00	278.25	221.75	.....
Incidentals	2,000.00	2,083.04	.....	83.04
Outstanding liabilities	2,615.84	2,615.84	.....	.....
Total	60,495.84	49,712.48	17,959.77	7,176.41

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Money statement.

July 1, 1904, balance unexpended	$9,495.84
Amount allotted during fiscal year	51,000.00
	60,495.84
June 30, 1905, amount expended during fiscal year	49,712.48
July 1, 1905, balance unexpended	10,783.36
July 1, 1905, outstanding liabilities	709.00
July 1, 1905, balance available	10,074.36

COMMERCIAL STATISTICS.

Traffic.

Vessels, etc.	Lock No. 7.			Lock No. 8.			Lock No. 9.		
	Ascending.	Descending.	Total.	Ascending.	Descending.	Total.	Ascending.	Descending.	Total.
Passenger boats	7	8	15	10	8	18	7	6	13
Towboats	29	29	58	30	29	59	24	22	46
Government boats	23	24	47	23	23	46	33	35	68
Other barges	8	9	17	1	2	3	.....	1	1
Government barges	82	78	160	122	122	244	142	142	284
Government small craft	1	3	4	4	3	7	7	5	12
Small craft	10	8	18	3	7	10	7	18	25
Rafts	.....	54	54	.....	9	9	.....	6	6
Total	160	213	373	193	203	396	220	235	455
Lockages	58	80	138	70	80	150	63	78	141

Vessels, etc.	Lock No. 10.			Lock No. 11.			Lock No. 12.		
	Ascending.	Descending.	Total.	Ascending.	Descending.	Total.	Ascending.	Descending.	Total.
Towboats	26	23	49	28	28	56	27	27	54
Government boats	39	39	78	53	55	108	54	54	108
Other barges	2	3	5	1	3	4	1	3	4
Government barges	148	146	294	168	171	339	156	149	305
Government small craft	13	16	29	30	31	61	23	23	46
Small craft	.....	2	2	8	17	25	7	15	22
Rafts	3	2	5	6	5	11	6	6	12
Total	231	231	462	294	310	604	274	277	551
Lockages	74	76	150	125	134	259	116	124	240

Commerce.

[In tons.]

LOCK NO. 7.

Date.	Coal.	Cotton.	Hay.	Stone.	Logs.	Lumber.	General and miscellaneous.	Total.
1904.								
July	.....	.....	3	75	.....	.....	7	85
August	.....	.....	7	.....	200	.....	.....	207
September	.....	.....	.....	.....	.....	.....	.....	.....
October	.....	.....	.....	.....	.....	.....	5	5
November	.....	.....	.....	.....	.....	.....	.....	.....
December	.....	.....	.....	.....	118	.....	.....	118
1905.								
January	.....	191	.....	552	250	.....	112	1,105
February	.....	35	.....	1,064	243	.....	.....	1,342
March	81	101	.....	1,788	1,200	.....	261	3,431
April	1,008	76	.....	1,633	26	.....	64	2,807
May	800	.....	.....	1,836	170	.....	110	2,916
June	196	.....	.....	432	99	120	90	937
Total	2,085	403	10	7,380	2,306	120	649	12,953

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Commerce—Continued.

LOCK NO. 8.

Date.	Coal.	Corn.	Flour.	Sugar.	Cotton.	Cotton seed.	Stone.
1904.							
July							
August							
September							
October							1,792
November							870
December							1,991
1905.							
January			15		81	22	2,380
February					36		713
March	81		17	1	89		1,788
April	1,013	5	15		58	6	1,633
May	987						2,119
June	109						149
Total	2,140	5	47	1	264	28	13,435

Date.	Sand and gravel.	Logs.	Lumber.	Fertilizer.	General and miscellaneous.	Total.
1904.						
July					1	1
August						
September						
October	1,163				5	2,960
November					115	985
December						1,991
1905.						
January		54	20	35	75	2,682
February		56			80	885
March		44		286	10	2,816
April		26			96	2,852
May		208			110	3,374
June		99	120		90	567
Total	1,163	487	140	321	582	18,613

LOCK NO. 9.

Date.	Coal.	Oil.	Cotton.	Steel rails.	Cotton seed.	Stone.
1904.						
July						
August						
September	138					1,408
October						2,572
November	87					1,943
December	80					2,198
1905.						
January			88		36	2,380
February			88			1,619
March		2	55		18	1,788
April	1,008			17		1,633
May	937					2,119
June	109					149
Total	2,359	2	131	17	54	17,804

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Commerce—Continued.

LOCK NO. 9—Continued.

Date.	Logs.	Lumber.	Fertilizer.	General and miscellaneous.	Total.
1904.					
July				1	1
August					
September				5	1,551
October				5	2,577
November				65	2,095
December				65	2,358
1905.					
January					2,454
February			70	12	1,739
March			107	9	1,979
April	42			1	2,701
May	146			110	3,312
June	18	164		55	495
Total	206	164	177	328	21,242

LOCK NO. 10.

Date.	Coal.	Stone.	Sand and gravel.	Logs.	Lumber.	General and miscellaneous.	Total.
1904.							
July	125		577				702
August	87		475				562
September	81	2,359					2,440
October		2,496	80	224			2,800
November	90	1,908					1,998
December	100	2,123					2,223
1905.							
January		1,637			126		1,763
February		370					370
March	120	1,537					1,657
April	878	1,479		66			2,423
May	1,099	2,119		197		125	3,540
June	109	149				65	323
Total	2,689	16,177	1,132	487	126	190	20,801

LOCK NO. 11.

Date.	Coal.	Stone.	Sand and gravel.	Logs.	Lumber.	General and miscellaneous.	Total.
1904.							
July	125		577				702
August	92		300		7	50	449
September	94	2,526			8		2,628
October	10	2,966	80	224			3,280
November	90	1,583			49		1,722
December	240	2,651					2,891
1905.							
January		2,007			126		2,133
February		907					907
March	200	1,889					2,089
April	878	1,479		66	66	80	2,569
May	1,208	2,268		239		125	3,840
June	110					65	175
Total	3,047	18,276	957	529	251	320	23,380

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Commerce—Continued.

LOCK NO. 12.

Date.	Coal.	Stone.	Sand and gravel.	Logs.	Lumber.	General and miscellaneous.	Total.
1904.							
July	90		125				215
August	87		175		7	50	319
September	94	2,526			3		2,623
October	10	2,966	80	224			3,280
November	90	1,583			49		1,722
December	240	2,651					2,891
1905.							
January		2,007			126		2,133
February		907			130		1,037
March	200	1,889					2,089
April	878	1,479		66	66	80	2,569
May	1,208	2,268		239		125	3,840
June	110					65	175
Total	3,007	18,276	380	529	381	320	22,893

Comparative table of commerce through locks.

LOCK NO. 10.

Items.	Fiscal year ending June 30—								
	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.
Steamboats.....number..	67	283	172	71	94	59	305	204	127
Barges.....do....	89	403	118	87	180	131	420	451	299
Steamboats.....tonnage..	(a)	6,165	3,655	1,892	3,135	3,621	18,345	18,693	18,560
Barges.....do....	(a)	29,032	5,770	5,465	19,265	12,884	24,990	30,930	24,700
Passengers.....number..	58	203	348	36	28		101		
Lockages.....do....	228	537	220	118	199	118	434	276	150
FREIGHT CARRIED.									
Coal.....tons..	1,925	2,223	1,059	615	3,305	240	3,860	1,476	2,689
Corn.....do....					12				
Cotton.....do....				88					
Hay.....do....					10				
Steel rails.....do....				28			2		
Cement.....do....			88	22					
Stone.....do....		5,076			2,082	3,938	18,096	14,783	16,177
Sand and gravel.....do....		148			128	45	256	1,725	1,132
Oats.....do....					18				
Cross-ties.....do....		113							
Hewn timber.....do....		5,264							
Logs.....do....	149	4	342	138		87	533	638	487
Lumber.....do....	81	352	182	596	1,701	525	313	276	126
General and miscellaneous.....tons..	14	111	90	219	293	255	106	8	190
Total	2,169	13,291	1,761	1,656	7,549	5,090	18,166	18,906	20,801

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Comparative table of commerce through locks—Continued.

LOCK NO. 11.

Items.	Fiscal year ending June 30—								
	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.
Steamboats.....number..	294	633	297	104	371	263	653	347	164
Barges .....do....	235	439	147	105	162	268	464	479	343
Steamboats .....tonnage..	(a)	13,985	6,431	2,657	9,111	8,708	27,007	24,138	26,003
Barges .....do....	(a)	33,590	7,800	6,750	21,479	24,312	27,220	32,485	26,690
Passengers .....number..	1,342	2,994	721	71	1,275	494	1,750	677	.....
Lockages .....do....	584	774	354	208	506	455	931	589	259
FREIGHT CARRIED.									
Coal.....tons..	4,706	4,139	1,269	707	3,945	450	4,211	1,852	3,047
Corn .....do....	.....	25	.....	.....	12	.....	.....	.....	.....
Cotton .....do....	.....	.....	.....	38	.....	.....	.....	.....	.....
Hay.....do....	.....	.....	.....	.....	10	.....	.....	.....	.....
Steel rails.....do....	.....	22	.....	20	.....	.....	.....	.....	.....
Cement .....do....	.....	9	88	22	.....	.....	.....	.....	.....
Stone .....do....	.....	5,210	.....	.....	1,277	6,320	13,096	14,783	18,276
Sand and gravel.....do....	.....	148	.....	.....	68	45	202	1,725	967
Oats.....do....	.....	.....	.....	.....	18	.....	.....	.....	.....
Posts.....do....	.....	14	.....	.....	.....	.....	.....	.....	.....
Cross-ties .....do....	.....	113	.....	.....	.....	.....	.....	.....	.....
Hewn timber .....do....	.....	5,527	.....	.....	.....	.....	.....	.....	.....
Logs .....do....	165	16	392	138	.....	87	533	677	529
Lumber.....do....	146	514	346	626	1,713	805	154	170	251
General and miscellaneous.....tons..	44	320	110	285	430	157	206	153	320
Total	5,061	16,057	2,205	1,836	7,473	7,864	18,402	19,360	23,380

a No record kept.

LOCK NO. 12.

Steamboats.....number..	309	636	308	111	473	471	662	348	162
Barges .....do....	211	474	151	110	271	543	679	587	309
Steamboats .....tonnage..	(a)	13,582	6,729	2,948	11,635	13,937	27,196	24,284	23,139
Barges .....do....	(a)	35,790	8,060	7,020	28,430	38,942	35,950	36,000	25,420
Passengers .....number..	1,538	3,089	732	111	1,482	828	1,911	857	.....
Lockages .....do....	551	815	372	228	614	660	901	513	240
FREIGHT CARRIED.									
Coal.....tons..	4,699	4,618	1,456	757	4,255	625	4,211	1,932	3,007
Corn .....do....	.....	25	.....	.....	12	.....	.....	.....	.....
Cotton .....do....	.....	.....	.....	38	.....	.....	.....	.....	.....
Hay.....do....	.....	.....	.....	.....	10	.....	.....	.....	.....
Steel rails.....do....	.....	22	.....	20	.....	.....	.....	.....	.....
Cement .....do....	.....	9	88	22	.....	.....	.....	.....	.....
Stone .....do....	.....	5,290	.....	.....	1,804	9,314	13,096	14,872	18,276
Sand and gravel.....do....	.....	148	.....	.....	845	1,619	2,001	2,642	380
Oats .....do....	.....	.....	.....	.....	18	.....	.....	.....	.....
Posts.....do....	.....	14	.....	.....	.....	.....	.....	.....	.....
Cross-ties .....do....	.....	113	.....	.....	.....	.....	.....	.....	.....
Hewn timber .....do....	.....	5,728	.....	.....	.....	.....	.....	.....	.....
Logs .....do....	178	74	332	138	.....	87	590	663	529
Lumber.....do....	139	514	346	626	1,718	805	154	170	381
General and miscellaneous.....tons..	44	320	110	285	487	170	218	153	320
Total	5,060	16,875	2,332	1,886	9,149	12,820	20,270	20,432	22,893

a No record kept.

R 5.

IMPROVEMENT OF PASCAGOULA RIVER, MISSISSIPPI.

Accounts of this improvement are contained in the Annual Reports of the Chief of Engineers for 1900, page 2211; 1902, page 1305, and 1904, page 1828.

The river and harbor act of June 13, 1902, modified the existing project for this improvement by increasing the depth to be obtained

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in the channel from 12 feet at mean low water to 17 feet at the same stage of tide.

During 1903 and 1904 a channel with a depth of 15 feet and with a width of from 75 to 100 feet was dredged within the limits of this project except over one small shoal at the extreme upper end of the improvement. As a result of this work vessels with a draft of from 14 to 15 feet have been able to navigate the river, so that while in 1902 only about 45 per cent of the exports via Horn Island Pass could be loaded in Pascagoula River, in 1904 about 71 per cent of these exports were loaded there, thus effecting the saving of a considerable amount of money which otherwise would have been expended in the rehandling of cargoes.

During the past fiscal year no contract work has been in progress. The river and harbor act of March 3, 1905, carried an appropriation of $150,000 for continuing the Pascagoula River improvement, and during the coming fiscal year it is proposed to apply these funds to the work of dredging a 17-foot channel to such width as may be possible within the limits of the project. Proposals for this work were opened on May 31, 1905, and contracts for its performance were entered into under date of June 16, 1905, with the Southern Dredging Company of Mobile, Ala., for work in section 1 at the price of 9.98 cents per cubic yard, place measurement, and with John Andersen, of Gulfport, Miss., for work in section 2 at 8 cents per cubic yard, place measurement. The latter of these contracts was approved by the Chief of Engineers June 28, 1905, while the former has not yet been approved.

Expenditures during the past fiscal year have amounted to $21,798.88 for final payments on dredging contract, survey work, and contingent operations.

It is proposed to apply future appropriations to the work of widening to its projected dimensions the 17-foot channel which will be obtained under the present contracts.

On June 30, 1905, the channel had shoaled in places to about 13 feet at low water. These shoals are, however, very soft.

Money statement.

July 1, 1904, balance unexpended		$29,214.06
Amount appropriated by river and harbor act approved March 3, 1905		150,000.00
		179,214.06
June 30, 1905, amount expended during fiscal year, for works of improvement		21,798.88
July 1, 1905, balance unexpended		157,415.18
July 1, 1905, outstanding liabilities		850.00
July 1, 1905, balance available		156,565.18
July 1, 1905, amount covered by uncompleted contracts		120,000.00
Amount (estimated) required for completion of existing project		520,622.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905		400,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

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APPROPRIATIONS.

March 2, 1827	$8,000.00	March 3, 1899	[b]$30,000.00
May 23, 1828	17,500.00	June 6, 1900	[b]199,600.00
August 30, 1852	5,000.00	June 13, 1902	25,000.00
June 17, 1878	10,000.00	March 3, 1903	100,000.00
March 3, 1879	14,000.00	April 28, 1904	25,000.00
June 14, 1880	20,000.00	March 3, 1905	150,000.00
August 5, 1886	20,000.00		
August 5, 1886 (transferred from Horn Island Pass appropriation)	5,000.00	Total	699,100.00
August 11, 1888	27,000.00	Less cost of Horn Island Pass dredging in 1897, from appropriations of 1894 and 1896	7,682.40
September 19, 1890	[a]18,000.00		
July 13, 1892	[a]16,200.00	Balance	691,417.60
August 18, 1894	[a]7,600.00		
June 3, 1896	[a]1,200.00		

CONTRACT IN FORCE.

With John Andersen, of Gulfport, Miss., dated June 16, 1905, approved by the Chief of Engineers June 28, 1905, for dredging in section 2, Mississippi Sound, Mississippi, at the rate of 8 cents per cubic yard for material removed, measured in place, work to be commenced by July 30, 1905, and to be completed by January 31, 1906.

COMMERCIAL STATISTICS.

The following statement concerning the clearances from the port of Pascagoula for the calendar year ending December 31, 1904, was furnished by the United States custom-house at Pascagoula, Miss.:

Foreign clearances	153
Domestic clearances	17
Net tonnage	[c]73,351
Customs receipts	$2,409

The following statement concerning the commerce of the Pascagoula River for the calendar year ending December 31, 1904, was furnished by the Pascagoula Commercial Club, of Scranton, Miss.:

Articles.	Quantity.	Value.
Arriving:		
Logs and timber	*Tons.* 430,000	$1,290,000
Fish and oysters	1,125	39,000
Total	431,125	1,329,000
Departing:		
Lumber and timber	283,000	2,670,000
Rosin	10,000	150,000
Turpentine	3,750	400,000
Charcoal	8,000	80,000
Total	304,750	3,300,000

[a] Portions of Pascagoula River appropriations applied to dredging work.

[b] Excluding a total of $88,000 applied to dredging in Horn Island anchorage.

[c] In addition to the above, 125 vessels, with an aggregate net tonnage of 150,000 tons, with cargoes from the port of Pascagoula, cleared from adjacent ports.

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R 6.

IMPROVEMENT OF PASCAGOULA, LEAF, AND CHICKASAHAY RIVERS, MISSISSIPPI.

The river and harbor act of June 13, 1902, combined the existing projects for the improvement of the Pascagoula, Leaf, and Chickasahay rivers, Mississippi, for which appropriations had formerly been made separately, into one work of improvement. From the joint appropriation of $12,000 carried by the act of March 3, 1905, for the improvement of these three streams, $6,750 was allotted to the Pascagoula River, $3,250 to the Leaf River, and $2,000 to the Chickasahay River.

(A) PASCAGOULA RIVER.

This river was worked over in 1902 and 1903, and placed in condition for rafting and light-draft navigation. The work of improvement was then suspended owing to lack of funds, and was not resumed until June, 1905.

With the funds allotted from the river and harbor act of March 3, 1905, repairs were made to plant, property was purchased, and a snagging party was organized after the river stage had become favorable for work. Snagging operations were commenced at Moss Point, Mississippi, on June 19, 1905, and were prosecuted upstream from that point. During the balance of the month a distance of 40 miles of river was restored to a navigable condition. Expenditures during the year have amounted to $576.38, of which the sum of $218 was applied to the care and preservation of public property.

With funds available it is proposed to remove existing obstructions from the channel of the stream within the limits of the project, while future appropriations will be applied to a continuation of the work of maintenance.

Money statement.

July 1, 1904, balance unexpended	$261.78
Amount allotted from river and harbor act approved March 3, 1905	6,750.00
	7,011.78
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	576.38
July 1, 1905, balance unexpended	6,435.40
July 1, 1905, outstanding liabilities	260.00
July 1, 1905, balance available	6,175.40
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	5,000.00

(B) LEAF RIVER.

Snagging operations on this stream have not been in progress since December 31, 1902, owing to lack of funds.

With the allotment made available by the river and harbor act of March 3, 1905, it is proposed to prosecute maintenance work on this

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stream during the coming fiscal year, by removing the many obstructions which have lodged in the channel since work was last in progress.

It is proposed to apply future appropriations to similar work at this locality, as it becomes necessary, as this project is one of maintenance.

Expenditures during the year have amounted to $250.30, which amount has been applied to the preservation and care of public property and the purchase of working materials.

Money statement.

July 1, 1904, balance unexpended	$250.30
Amount allotted from river and harbor act approved March 3, 1905	3,250.00
	3,500.30
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	250.30
July 1, 1905, balance unexpended	3,250.00
July 1, 1905, outstanding liabilities	150.00
July 1, 1905, balance available	3,100.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	5,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(c) CHICKASAHAY RIVER.

Owing to lack of funds, no snagging work has been in progress on this stream since October 19, 1903.

With the funds appropriated by the river and harbor act of March 3, 1905, it is proposed to undertake maintenance work on this stream within the limits of the project during the coming fiscal year.

Expenditures during the fiscal year ending June 30, 1905, have amounted to $223. This sum has been applied to the care and preservation of public property.

Money statement.

July 1, 1904, balance unexpended	$223.00
Amount allotted from river and harbor act approved March 3, 1905	2,000.00
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	2,223.00
July 1, 1905, balance unexpended	2,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	5,000.00
Submitted in compliance with requirements of the sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

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APPROPRIATIONS.

For Pascagoula River:	
March 3, 1881	$4,000
August 2, 1882	8,000
July 5, 1884	3,000
September 19, 1890	[a] 2,000
July 13, 1892	[a] 3,800
August 18, 1894	[a] 5,400
June 3, 1896	[a] 4,800
June 13, 1902 (allotment)	4,000
March 3, 1905 (allotment)	6,750
Total	41,750
For Leaf River:	
September 19, 1890	5,000
July 13, 1892	5,000
August 18, 1894	2,500
June 3, 1896	2,500
For Leaf River—Continued.	
March 3, 1899	$2,500
June 13, 1902 (allotment)	2,250
March 3, 1905 (allotment)	3,250
Total	23,000
For Chickasahay River:	
September 19, 1890	5,000
July 13, 1892	5,000
August 18, 1894	5,000
June 3, 1896	2,000
March 3, 1899	2,500
June 13, 1902 (allotment)	2,250
March 3, 1905 (allotment)	2,000
Total	23,750

COMMERCIAL STATISTICS.

The following statement concerning the commerce of the Pascagoula River and its tributaries, the Chickasahay and Leaf rivers, for the calendar year ending December 31, 1904, was furnished by the Pascagoula Commercial Club, of Scranton, Miss.:

Articles.	Quantity.	Value.	Articles.	Quantity.	Value.
Pascagoula River;	*Tons.*		Leaf River—Continued.	*Tons.*	
Logs, lumber, piling, etc.	164,000	$492,000	Rosin	200	$4,000
Turpentine	3,000	360,000	General merchandise	50	2,500
Rosin	9,000	180,000	Total	196,300	600,500
Charcoal	1,250	12,500	Chickasahay River;		
General merchandise	3,000	150,000	Logs and timber	66,000	198,000
Total	180,250	1,194,500	Turpentine	125	15,000
Leaf River:			Rosin	500	10,000
Logs and timber	196,000	588,000	General merchandise	250	15,000
Turpentine	50	6,000	Total	66,875	238,000

NOTE.—The tonnages of the Leaf and Chickasahay rivers passed down the Pascagoula River, but in the above statements the business originating on each stream is included alone.

R 7.

IMPROVEMENT OF HORN ISLAND PASS, MISSISSIPPI.

The existing project for this improvement was adopted in the river and harbor act of March 3, 1905, and provides for obtaining a 21-foot channel through the outer and inner bars of the Pass, the width of the cut to be 300 feet across the outer bar and 200 feet elsewhere.

A description of earlier work performed in Horn Island Pass is contained in the Annual Report of the Chief of Engineers for 1897, page 1694, and of work performed in Horn Island anchorage in the Report for 1901, page 1842.

The existing low-water depth through the Pass is 18 feet, and the range of the tide is about 1.1 feet.

[a] Portions of Pascagoula River appropriations applied to snagging work.

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The river and harbor act of March 3, 1905, made the following appropriation for this locality:

Improving Horn Island Pass, Mississippi, with a view to obtaining a channel twenty-one feet in depth and three hundred feet in width across the outer bar, two hundred feet wide elsewhere, in accordance with the report submitted in House Document Numbered Five hundred and six, Fifty-eighth Congress, second session, forty thousand four hundred and eighty dollars: *Provided*, That a contract or contracts can be made at a sum not to exceed the unit price of eleven cents per cubic yard, or such work can be performed by Government dredge.

In response to a public advertisement, dated May 16, 1905, of the proposed work at Horn Island Pass, no bids were received, and the performance of this work at the price of 11 cents per cubic yard therefore seems improbable.

During the coming fiscal year, available funds will be applied to the execution of dredging a 21-foot channel through Horn Island Pass, provided that a Government dredge can be secured for the work, or that its performance by contract at a price not to exceed the conditional figure be found practicable. Future appropriations will be applied to the work of maintaining the channel, which may be obtained with funds now available.

No expenditures have been made in connection with this work of improvement.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1905	$40,480.00
July 1, 1905, balance unexpended	40,480.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	9,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

APPROPRIATIONS.

August 18, 1894, and June 3, 1896 (allotments)	$7,682.40
March 3, 1899 (allotment, Horn Island anchorage)	20,000.00
June 6, 1900 (allotment, Horn Island anchorage)	68,000.00
March 3, 1905	40,480.00
Total	136,162.40

COMMERCIAL STATISTICS.

During the calendar year 1904, about 170 vessels with cargoes passed through Horn Island Pass. These cargoes consisted of about 110,000 tons of lumber and timber valued at $1,052,000.

R 8.

IMPROVEMENT OF HARBOR AT BILOXI, MISSISSIPPI.

An account of the work performed at this locality is contained in the Annual Report of the Chief of Engineers for 1894, page 1325, and for 1904, page 1833.

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No contract work has been in progress in connection with this improvement during the past year, owing to the lack of funds. Expenditures during the year, amounting to $165.64, have been applied to incidental expenses.

The river and harbor act of March 3, 1905, appropriated $9,000 for the maintenance of the Biloxi channel. With these funds it is proposed to enter into contract during the coming fiscal year for work at Biloxi, in order to remove shoals in the dredged cut, thereby maintaining an 8-foot channel, as called for in the project.

On June 30, 1905, the minimum depth in the channel at low water was 7 feet. The range of the tide is about 1¼ feet.

Future appropriations will be applied to a continuation of maintenance work as it becomes necessary.

Money statement.

July 1, 1904, balance unexpended	$165.64
Amount appropriated by river and harbor act approved March 3, 1905	9,000.00
	9,165.64
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	165.64
July 1, 1905, balance unexpended	9,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	12,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

APPROPRIATIONS.

August 2, 1882	$5,000.00
August 5, 1886	12,500.00
August 11, 1888	18,500.00
September 19, 1890	9,000.00
June 13, 1902	10,000.00
March 3, 1905	9,000.00
Total	64,000.00
Less amount turned back into Treasury, January, 1896	617.73
Balance	63,382.27

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR ENDING DECEMBER 31, 1904.

[Approximate.]

Articles.	Quantity.	Value.	Articles.	Quantity.	Value.
IMPORTS.			EXPORTS.		
	Tons.			*Tons.*	
Oysters, fish, shrimp, etc	114,000	$630,652	Lumber and timber	70,000	$560,000
Lumber, brick, and building material	20,400	90,768	Naval stores, charcoal, etc.	12,000	395,000
			Oysters, fish, shrimp, etc	5,000	225,000
General merchandise	30,000	574,135	General merchandise	3,000	60,000
Total	164,400	1,295,555	Total	90,000	1,240,000

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R 9.

CHANNEL FROM GULFPORT TO SHIP ISLAND HARBOR, MISSISSIPPI.

Dredging at this locality under the existing contract with Mr. Spencer S. Bullis, of Gulfport, Miss., was commenced April 16, 1901, and has been prosecuted continuously since that date. This contract calls for the completion of a channel 300 feet wide between Ship Island Harbor and Gulfport, Miss., with an anchorage basin at its shore end 2,640 by 1,320 feet in area, both with a depth of 19 feet at low water.

The work of dredging the channel to its projected dimensions was completed in the fiscal year 1903. The contractor then commenced redredging the central portions of the channel, in order to remove some shoals and to insure a sufficient depth therein at the time of the final examination. This latter work was completed in July, 1903. Since that time operations have been directed principally toward the completion of the anchorage basin, and two hydraulic dredges have been engaged on the latter work, except between December, 1903, and December, 1904, when the hydraulic dredge *Cape Charles* was engaged on some additional redredging in the channel and in undergoing repairs.

A survey party was organized May 1, 1905, and commenced the final survey of the Gulfport channel and anchorage basin at that time. It was found, however, that although the projected depth of 19 feet existed in the center of the channel, the sides of the cut were somewhat shoal and that some redredging would be necessary to place the channel in condition for acceptance. The latter work was therefore undertaken by the contractor about June 1, and is now in progress.

On June 30, 1905, the depths in the center of the dredged channel varied from 19½ to 22 feet, while the projected depth of 19 feet existed over the entire area of the anchorage basin except at a few places near its north boundary.

It is proposed to hold available funds for contract payments until the completion of the channel and basin to their projected dimensions. The funds appropriated in the sundry civil act of April 28, 1904, for maintenance, will be held until the channel and basin have been properly maintained for the period of one year after acceptance by the United States.

Statement of expenditures for examinations and inspections of work of dredging a channel and anchorage basin between Ship Island Harbor and Gulfport, Miss., during the fiscal year ending June 30, 1905.

[Submitted in accordance with Circular No. 12, Office of the Chief of Engineers, dated July 31, 1897.]

Item.	Allotted.	Expended.	Balance.
Inspection and superintendence	$1,575.00	$62.11	$1,512.89
Examinations and surveys	6,250.00	969.36	5,280.64
Office expenses	1,250.00	210.00	1,040.00
Mileage	150.00	10.29	139.71
Incidentals	500.20		500.20
Total	9,725.20	1,251.76	8,473.44

The river and harbor act of March 3, 1905, authorized an examination of the "Anchorage basin at Gulfport, and channel therefrom to

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the anchorage or roadstead at Ship Island, with a view to obtaining a sufficient depth and width. Also Ship Island Pass, between Ship and Cat islands." A report on this examination will be submitted early in the coming fiscal year.

Money statement.

July 1, 1904, balance unexpended	$169,013.20
June 30, 1905, amount allotted during fiscal year	712.00
	169,725.20
June 30, 1905, amount expended during fiscal year, for works of improvement	1,251.76
July 1, 1905, balance unexpended	168,473.44
July 1, 1905, amount covered by uncompleted contracts	160,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	10,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

APPROPRIATIONS.

July 5, 1884 (allotments)	$21,194.04
June 28, 1902	150,000.00
April 28, 1904 (maintenance)	10,000.00
Total	181,194.04

CONTRACT IN FORCE.

With Spencer S. Bullis, dated February 20, 1901, approved by the Chief of Engineers March 18, 1901, for dredging a channel and anchorage basin in Mississippi Sound, between Ship Island Harbor and Gulfport, Miss., for $150,000, and for maintaining said channel and anchorage basin for a period of five years after its completion for the sum of $10,000 annually. Work commenced April 16, 1901; was to be completed by April 16, 1903. Time of completion has been extended for such period as is deemed reasonable by the district engineer officer. Maintenance to commence immediately upon completion of the channel and basin.

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR ENDING DECEMBER 31, 1904.

Clearances.

Steamships	97
Ships	13
Barks	78
Schooners	81
Total	269
Tonnage	390,394

Articles.	Quantity.	Value.	Articles.	Quantity.	Value.
EXPORTS.			IMPORTS.		
	Tons.			*Tons.*	
Lumber and timber	408,000	$3,195,000	Iron pyrites	6,100	$24,400
Naval stores	28,200	467,000	Phosphate	3,000	45,000
Total	436,200	3,662,000	Total	9,100	69,400

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R 10.

IMPROVEMENT OF PEARL RIVER BELOW ROCKPORT, MISSISSIPPI.

Snagging operations under the appropriation of 1902 were completed on November 23, 1903. Work was suspended at that time on account of lack of funds. As a result of this work the lower portions of the stream had been placed in a safe condition for light-draft navigation.

Under date of May 31, 1904, an allotment of $2,000 from the contingent appropriation for emergencies in river and harbor works, act of June 13, 1902, was made for this improvement. With these funds between October 3, 1904, and January 6, 1905, a revetment was constructed across the head of Moores Bayou, in order to keep the river in its channel and to prevent the formation of a cut-off. This revetment was constructed of piles, driven close, capped and braced, and protected by earth filling. The total cost of this work was $1,286.39. The balance of the allotment, amounting to $713.61, was turned back into the Treasury on May 23, 1905.

The river and harbor act of March 3, 1905, appropriated $7,000 for the improvement and maintenance of the Pearl River below Rockport. Working property has been purchased, repairs were made to plant, the snag boat *Pearl* was towed from Mobile to Indian Village, West Pearl River, and snagging operations were commenced at the latter point on June 21, 1905. During the balance of the month obstructions were removed from the channel of the river for a distance of 17 miles above Indian Village.

The expenditures during the fiscal year ending June 30, 1905, have amounted to $1,561.31, all of which was applied to maintenance.

It is proposed to prosecute the work of improvement and maintenance during the coming fiscal year with funds now available, devoting $2,000 to the former work, and to apply future appropriations to similar work of maintenance.

The river and harbor act approved March 3, 1905, authorized an examination of Pearl River from the mouth to Rockport. A report on this examination will be submitted during the coming fiscal year.

No reliable figures as to the total amount of commerce of this stream could be obtained.

Money statement.

July 1, 1904, balance unexpended		$2,225.98
Amount appropriated by river and harbor act approved March 3, 1905.		7,000.00
		9,225.98
June 30, 1905, amount expended during fiscal year:		
Amount turned back into Treasury	$713.61	
For maintenance of improvement	1,561.31	
		2,274.92
July 1, 1905, balance unexpended		6,951.06
July 1, 1905, outstanding liabilities		870.00
July 1, 1905, balance available		6,081.06
Amount (estimated) required for completion of existing project		31,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905		10,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

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APPROPRIATIONS.

June 14, 1880	$30,000.00	August 18, 1894	$5,000.00
March 3, 1881	25,000.00	June 3, 1896	10,000.00
August 2, 1882	15,000.00	March 3, 1899	7,000.00
July 5, 1884	10,000.00	June 13, 1902	7,000.00
August 5, 1886	13,125.00	June 13, 1902 (allotment)	1,286.39
August 11, 1888	10,000.00	March 3, 1905	7,000.00
September 19, 1890	15,000.00		
July 13, 1892	15,000.00	Total	170,411.39

R 11.

IMPROVEMENT OF PEARL RIVER BETWEEN EDINBURG AND JACKSON, MISSISSIPPI.

The river and harbor act of June 13, 1902, made a single appropriation for the two upper sections of the Pearl River, one from Carthage to Jackson and the other from Edinburg to Carthage, thus combining into one work the projects for the improvement of these two sections of the stream.

The existing project for this improvement contemplates the maintenance of the improved channel between Edinburg and Jackson obtained under earlier appropriations. In conformity with this project, snagging operations were in progress at intervals between September 9, 1902, and September 17, 1903, when work was suspended owing to lack of funds. No work has been done since the latter date, but with funds appropriated in the river and harbor act of March 3, 1905, it is proposed to resume snagging operations on this stream during the coming fiscal year.

Expenditures during the past fiscal year have amounted to $183.73 and have been applied to preservation and care of public property.

Future appropriations will be applied to the work of maintaining a high-water channel on this section of the Pearl River.

No commercial statistics relating to this improvement could be obtained.

This section of Pearl River is not considered worthy of further improvement by the United States owing to the small amount of commerce using it.

Money statement.

July 1, 1904, balance unexpended	[a] $261.91	
Amount appropriated by river and harbor act approved March 3, 1905	4,000.00	
		4,261.91
June 30, 1905, amount expended during fiscal year, for maintenance of improvement		183.73
July 1, 1905, balance unexpended		4,078.18

[a] Erroneously reported last year as $261.88.

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APPROPRIATIONS.

Carthage to Jackson.

March 3, 1879	$6,000	July 13, 1892	$5,000
June 14, 1880	7,500	August 18, 1894	2,400
March 3, 1881	2,500	June 3, 1896	2,400
August 2, 1882	2,500	March 3, 1899	2,500
August 6, 1886	2,250		
August 11, 1888	2,500	Total	38,550
September 19, 1890	3,000		

Edinburg to Carthage.

July 5, 1884	$2,500	August 18, 1894 (maintenance)	$500
August 5, 1886	2,250	June 3, 1896 (maintenance)	500
August 11, 1888	5,000	March 3, 1899 (maintenance)	1,000
September 19, 1890	5,000		
July 13, 1892 (maintenance)	500	Total	17,250

Edinburg to Jackson.

June 13, 1902	$3,000
March 3, 1905	4,000
Total	7,000

R 12.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

On March 15, 1904, an allotment of $350 was made from the indefinite appropriation for removing sunken vessels or craft obstructing or endangering navigation, for the purpose of defraying the cost of shifting the wreck of the Russian bark *Hilja* so as to prevent the vessel from sinking in the channel of Horn Island Harbor, Mississippi, and to effect the removal of the wreckage of iron masts and yards from this vessel, which had fallen overboard in the anchorage area. The latter work had been performed under emergency, on March 4, 1904. The work of removing the wreckage of the masts and yards was undertaken by the owners of the wreck in June, 1904, after notice had been given them as to the requirements of the law, and this work was reported completed in July, 1904. Subsequent examination showed the wreckage to have been removed satisfactorily. The total cost of this work was $133.40, and the balance of the allotment, amounting to $216.60, was turned back into the Treasury on January 18, 1905.

On May 17, 1905, an allotment of $600 was made from the indefinite wreck appropriation for the purpose of removing the wreck of the gravel barge *Goodwin*, which had sunk in Mobile Bay off Cedar Point. Arrangements for prosecuting the work of removing this wreck are now in progress.

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APPENDIX S.

IMPROVEMENT OF THE PASSES OF THE MISSISSIPPI RIVER, OF BAYOU LAFOURCHE, OF BAYOU PLAQUEMINE, GRAND RIVER, AND PIGEON BAYOUS, AND OF BAYOU TECHE, LOUISIANA.

REPORT OF LIEUT. COL. CLINTON B. SEARS, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1905, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Closing crevasse in Pass a Loutre, Mississippi River.
2. Outlet of Mississippi River.
3. Southwest Pass, Mississippi River.
4. Examinations and surveys at South Pass, Mississippi River.
5. Maintenance and improvement of South Pass channel, Mississippi River.
6. Bayou Lafourche, Louisiana.
7. Bayou Plaquemine, Grand River, and Pigeon bayous, Louisiana.
8. Bayou Teche, Louisiana.
9. Removing sunken vessels or craft obstructing or endangering navigation.

UNITED STATES ENGINEER OFFICE,
New Orleans, La., July 10, 1905.

GENERAL: I have the honor to submit herewith annual reports upon works of river and harbor improvement for this district for the fiscal year ended June 30, 1905.

Very respectfully,

CLINTON B. SEARS,
Lieut. Col., Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

S 1.

CLOSING CREVASSE IN PASS A LOUTRE, MISSISSIPPI RIVER.

For references as to progress of the work and condition of the dam on June 30, 1904, see page 1881, Annual Report of the Chief of Engineers for 1904. There has been no change in the condition of the dam during the past fiscal year.

A chart is forwarded herewith showing results of a survey of the Pass a Loutre crevasse and vicinity made during the fiscal year.

The crevasse is gradually closing. Enormous deposits of sediment have been made both above and below the remaining portions of the

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dam which was intended to close it, and the water now discharged through the crevasse finds its way to the open bay, a distance of 4 to 6 miles, through many shallow and narrow channels.

The mattress sill completed across the head of Pass a Loutre in December, 1900, has been the most potent factor in reducing the discharge of the crevasse. The area of cross section in Pass a Loutre, just above the crevasse, has decreased 5,600 square feet since the sill was completed, and the maximum depth in the crevasse has decreased as much as 30 feet.

Money statement.

July 1, 1904, balance unexpended	$21,004.92
February 2, 1905, amount received from proceeds of sale of Government property	25.00
July 1, 1905, balance unexpended	21,029.92

ABSTRACT OF APPROPRIATIONS.

By act of Congress approved February 26, 1897	[a] $250,000
Amount received from sale of Government property	25
Total	250,025

S 2.

IMPROVEMENT OF THE OUTLET OF THE MISSISSIPPI RIVER.

A history of the progress of the work will be found in the Annual Report of the Chief of Engineers for 1901, page 1878; see also Annual Report for 1902, page 1323.

During the fiscal year no work has been done or expenditures made under this appropriation by the New Orleans, La., office. For operations of the dredge *Benyaurd*, transferred to this district by Maj. J. C. Sanford, Corps of Engineers, on December 17, 1904, see report for "Maintenance of South Pass Channel, Mississippi River."

This work was dropped from the list of duties in this district on January 6, 1905, in accordance with authority of the Chief of Engineers.

Money statement.

July 1, 1904, balance unexpended, in hand under the New Orleans, La., office	$456.44
September 2, 1904, amount deposited to the credit of the appropriation, under instructions of the Chief of Engineers	456.44

ABSTRACT OF APPROPRIATIONS.

By act of Congress approved March 3, 1899	$200.000
By sundry civil act approved June 6, 1900	300,000
Total	500,000

[a] Of this amount $10,000 was allotted by act of February 17, 1898, for survey of Southwest Pass, Mississippi River.

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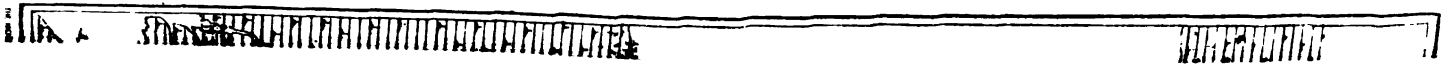

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S 3.

IMPROVEMENT OF SOUTHWEST PASS, MISSISSIPPI RIVER.

For progress of the work see page 1882, Annual Report of the Chief of Engineers for 1904.

During the past fiscal year work under contract with Christie & Lowe, for construction of jetties, was continued. One hundred and fourteen mattresses, held in place by stone, were placed in the east jetty, the foundation mats being extended to a point 22,100 feet from the shore end; 42 mats were placed in the second tier, 20 in the third, and 5 in the fourth tier. In the west jetty 81 foundation mattresses were placed, extending the jetty to a point 16,148 feet from its shore end. A total of 433,422⅔ square yards of mattress work and 112,559.9 tons of stone was placed in the jetties during the fiscal year, the contract prices being 96 cents per square yard and $1 per ton, respectively. For full data and description of the work see the accompanying report of Mr. Cornelius Donovan, United States assistant engineer.

The self-propelling dredge *Barnard*, provided for by the river and harbor act of June 13, 1902, was built under the direction of Maj. J. C. Sanford, Corps of Engineers, at Camden, N. J. The boat arrived at New Orleans on September 3, 1904. The work of putting the dredge in condition for operation was done at New Orleans in September and October, 1904. The dredge and ponton pipe line were transferred to South Pass in October, and began work on October 25. After five minutes' work the switching valve, from some unknown cause, became displaced, cutting off the discharge and directing it into one of the side discharges which was closed by a blank flange. There being no escape for the material pumped, the force reacted on the main pump, wrecking the pump casing and switching valve. The dredge returned to New Orleans on October 26, and preparations were immediately made for repairing the damage. A new pump casing was ordered from the makers of the dredge, which was received at New Orleans on March 8, 1905. The pump casing was installed and the dredge left for Southwest Pass on April 13, arriving on April 15. For operations of the dredge at Southwest Pass, see the accompanying report of Assistant Engineer Donovan.

On account of the advance of the crest of the bar at Southwest Pass since the date of the survey in 1898, on which the estimates for this improvement were based, it has become necessary to make provision for increasing the lengths of the jetties to correspond with this advance. This will necessarily increase the cost of the jetties. This extension is absolutely necessary to insure the ultimate success of the project.

In order to provide the funds required for prosecuting the work to the greatest advantage, to insure against the possible loss of portions of the jetties by storms, or of accident to the valuable plant engaged on this work, to provide for increasing the floating and other plant required on a work of this magnitude, and in general to insure the efficient and successful prosecution of the project and the early attainment of the projected depth of water through Southwest Pass, an early appropriation of $500,000, in addition to the amount authorized by the act of June 13, 1902, is earnestly recommended for the favorable consideration of Congress.

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Money statement.

July 1, 1904, balance unexpended		$1,417,553.15
Amount appropriated by sundry civil act approved March 3, 1905		1,250,000.00
		2,667,553.15
June 30, 1905, amount expended during fiscal year	$818,644.97	
Amount drawn on account of construction of dredges from January 1, 1904, to January 1, 1905	204,110.72	
Treasury settlement, February 9, 1905, in favor of Navy Department, for work done on dredge *Benyaurd*	7,127.19	
Amount allotted to Major Sanford, March 29, 1905, on account of dredge *Benyaurd*	200.00	
		1,030,082.88
July 1, 1905, balance unexpended		1,637,470.27
July 1, 1905, outstanding liabilities		185,899.45
July 1, 1905, balance available		1,451,570.82
July 1, 1905, amount covered by uncompleted contracts		1,079,444.56
Amount (estimated) required for completion of existing project		3,000,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905		500,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

ABSTRACT OF APPROPRIATIONS.

By act of Congress—	
Approved June 13, 1902	$750,000
Approved March 3, 1903	1,000,000
Approved March 3, 1905	1,250,000
Total	3,000,000

ABSTRACT OF CONTRACTS IN FORCE DURING FISCAL YEAR ENDING JUNE 30, 1905.

Name and address of contractor: Christie & Lowe, Chicago, Ill.

Work: Constructing two jetties at the mouth of Southwest Pass, Mississippi River. Estimated quantities of materials: Brush mattress, 960,000 square yards; riprap stone, 213,525 tons; concrete, 65,606 cubic yards. Increase or decrease of 20 per cent in above quantities allowed by specifications.

Contract price: Brush mattress, 96 cents per square yard; riprap stone, $4 per ton; concrete, $6.10 per cubic yard.

Date of contract: July 16, 1903.

Date of approval: July 31, 1903.

Date of commencement: October 2, 1903.

Date of expiration: August 3, 1907.

Name and address of contractor: The Johnson Iron Works (Limited), New Orleans, La.

Work: Rebuilding U. S. boat *Chere Amie.*

Contract price: $13,950.

Date of contract: December 28, 1904.

Date of expiration: May 28, 1905; time limit waived.

Emergency contract; to be paid jointly from the appropriations for improving Southwest Pass and maintenance of South Pass Channel, Mississippi River.

Name and address of contractor: New York Shipbuilding Company, Camden, N. J.

Work: Constructing pump casing for U. S. dredge *Barnard.*

Contract price: $2,710.

Date of contract: January 19, 1905.

Date of expiration and completion: February 25, 1905.

Emergency contract.

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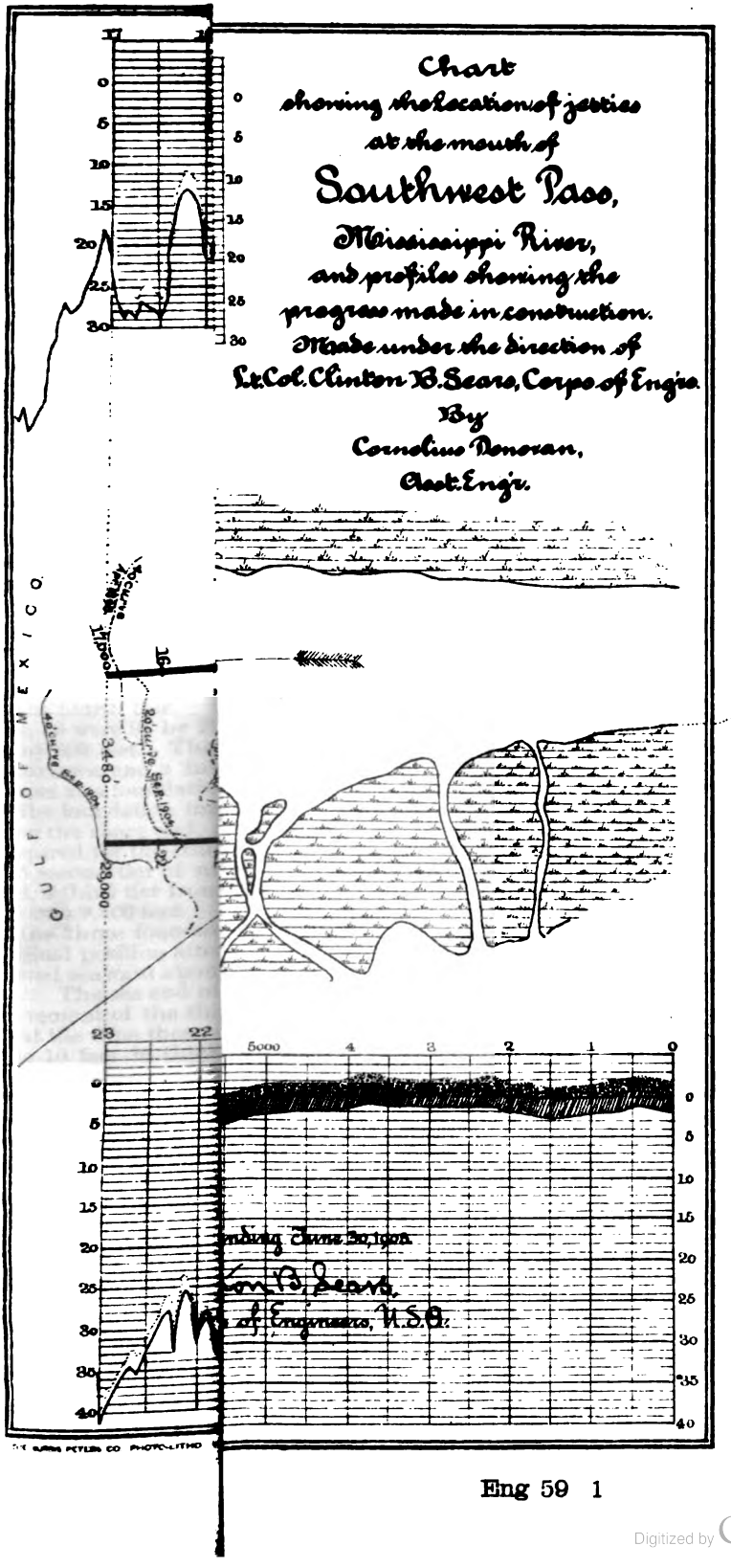
Chart
showing the location of jetties
at the mouth of
Southwest Pass,
Mississippi River,
and profiles showing the
progress made in construction.
Made under the direction of
Lt.Col. Clinton B. Sears, Corps of Engrs.
By
Cornelius Donovan,
Asst. Engr.
GULF OF MEXICO
Mississippi River
Pilot Town Passage
Southwest Pass
Jetties
Anchorage
Anchorage
Quarantine Station
Pilot Town
Pilot Town Passage
Anchorage
Anchorage
Anchor

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Name and address of contractor: The Johnson Iron Works (Limited), New Orleans, La.
Work: Constructing survey boat.
Contract price: $7,189.
Date of contract: January 19, 1905.
Date of expiration: May 29, 1905; time limit waived.

COMMERCIAL STATISTICS.

For commercial statistics for the port of New Orleans, see report on "Maintenance of South Pass Channel, Mississippi River."

REPORT OF MR. CORNELIUS DONOVAN, ASSISTANT ENGINEER.

NEW ORLEANS, LA., *July 5, 1905.*

SIR: I have the honor to report upon the improvement of the Southwest Pass of the Mississippi River during the fiscal year ending June 30, 1905.

Herewith is a chart which at a glance shows the location of the jetties and the progress made in constructing them. The details of the construction of mattresses, etc., are given on sheet No. 2, accompanying my last annual report.

WORK DONE DURING THE YEAR.

East jetty.—One hundred and fourteen mattresses were placed in this jetty during the year, 47 in the foundation tier, 42 in the second tier, 20 in the third tier, and 5 in the fourth tier. Twenty-seven of them were 100 by 200 feet, 20 were 150 by 200 feet, 30 were 95 by 200 feet, 16 were 75 by 200 feet, 6 were 55 by 200 feet, and 15 were 35 by 200 feet. The requisite amount of stone, 53,893.21 tons, was placed on these mattresses, and a further amount of 15,441.91 tons was placed on the surface mattresses as a foundation upon which the concrete capping will rest.

The foundation mattresses in this jetty are in place for a distance of 22,100 feet from the shore end, and for a distance of 8,900 feet from the same point the jetty is prepared for the concrete capping.

A second tier of mattresses are in place from 6,300 to 14,700 feet from the shore end, a third tier from 8,000 to 12,000 feet from the same point, and a fourth tier from 8,500 to 9,500 feet.

The three foundation mattresses at the sea end of this jetty moved from their original position after having been in place from one to three weeks. The end one moved seaward about 100 feet, and the sea end of it swung to the eastward about 70 feet. The sea end of the next mattress also moved to the eastward 70 feet, and the movement of the third one was not so much.

At the time these mattresses moved they were covered with a layer of sand from 1 to 10 feet in thickness, which gave evidence of that phenomenal movement of volumes of sand along the bottom. This, I have no doubt, is what caused the movement of the mattresses, and no amount of stone would have prevented it. The placing of mattresses at the sea end was discontinued until such time as the movement of sand had ceased. The mats moved will still be effectual in preventing a deepening around the end of the jetties.

West jetty.—During the month of August, 1904, the work of placing foundation mattresses in this jetty was commenced at a point 248 feet shoreward from station "0." Sixteen mattresses, 200 feet long and 100 feet wide, were built in place, as there was not sufficient water to float them.

Eighty-one mattresses were placed in this jetty over a length of 16,148 feet, the end of the outer one being at station 15+900. The mattresses are 200 feet in length, except one, which is 107 feet; 64 of them are 100 feet wide and 17 of them are 150 feet wide. The requisite amount of stone, 35,864 tons, was placed on the mattresses, being 40 pounds per square foot, and an additional 7,360.78 tons was placed over a distance of 3,600 feet from the shore end, and for a width of 18 feet and a depth of 2 feet as a foundation for concrete.

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During the year the contractors placed in both jetties 433,422⅔ square yards of mattress and 112,559.9 tons of stone.

SETTLEMENT AND COMPRESSION OF MATTRESSES.

In connection with mattresses built in place it was ascertained that after 40 or 50 pounds of stone per square foot was placed on them they settled into the bottom about two-tenths of a foot. After placing additional stone on them for a width of 18 feet and a thickness of 2 feet, the settlement varied from one-tenth to seven-tenths of a foot.

Where there are two tiers of mattresses the mean settlement and compression is five-tenths of a foot, and where there are three tiers it is four-tenths of a foot.

The settlement and compression was determined by elevations taken when the surface mat was placed and before adding the stone necessary to bring the jetty up to the level of mean high water, and at intervals since that time and up to June 30, 1905.

It is quite impracticable to determine how much of the decrease in elevation is due to compression and how much to the settlement of the mat into the bottom where the jetty is built of more than one tier of mattresses, but in the case of the surface mats the compression is generally about one-tenth of a foot.

Where the jetty is not built up to or near the surface it is impracticable to determine the settlement accurately. Soundings taken from time to time do not indicate any settlement, in fact in many places a decrease in the depth of water over the mat is shown in consequence of a deposit of sediment on the mattresses.

DREDGING.

The dredge *Barnard* arrived at Southwest Pass April 15, 1905, and at once began preparations for testing the plant in accordance with specifications.

Dredging was commenced April 21, and the test period ended with and included May 31. Since that date the dredge has been operated without her pipe line over the outer 1½ miles of the proposed channel, running in and out on a well-defined range and discharging the material on either side.

By this means it was expected that the current would carry out a large amount of material, and it was hoped that such increase in depth might be secured as would enable the dredge *Benyaurd* to operate in this portion of the channel.

Unfortunately the river had reached its highest stage before dredging was commenced, and therefore the advantage of a rising river was lost. Then, too, the past high stage was but a moderate one, reaching but 14 feet on Carrollton gauge.

The effect of dredging done was an increase of 2 feet in the mean depth over the outer bar.

The project for the improvement of Southwest Pass contemplated dredging the channel as the jetties were built out, but in order to do this an exit to the Gulf must be made through the outer bar for such dredge as is used.

The superstructure of the jetties is not sufficiently advanced to be of any material aid in assisting channel development or in protecting the dredged channel from the effect of heavy seas; but notwithstanding this it is believed that the dredge *Benyaurd* would, if she could work there, increase the depth materially.

The dredge *Barnard*, with her pipe line, can not be successfully operated on the outer bar on account of frequent and heavy seas. If, however, she could be so operated and the material deposited on either side of the channel, it would soon become an obstacle to the operations of the contractors by causing too shoal water, with which they are now contending in places for their tugs.

The results of capacity tests of the dredge *Barnard* gave a discharge of 409,000 cubic feet of water per hour when using the pipe line, the corresponding indicated horsepower of the pumping engine being about 1,000, and the revolutions per minute 130.6, which is the designed speed of the pump.

Without the pipe line, and pumping through the side discharges, the discharge of water per hour was 689,000 cubic feet. The indicated horsepower was 976, and the revolutions per minute 112.6.

The discharge in both cases was determined from readings obtained by means of a Pitot tube.

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SURVEYS.

During the month of September, 1904, a survey of the jetty channel was made as a basis for comparison with future surveys. At that time sufficient work had not been done to cause appreciable channel development, but now, that such development may be expected, more frequent surveys have been arranged for. A detailed survey now in progress has been delayed by unfavorable weather, but it is expected that it will be completed in a few days.

Respectfully submitted.

CORNELIUS DONOVAN,
Principal Assistant Engineer.

Lieut. Col. CLINTON B. SEARS,
Corps of Engineers.

S 4.

EXAMINATIONS AND SURVEYS AT SOUTH PASS, MISSISSIPPI RIVER.

In accordance with provisions of the river and harbor act approved June 13, 1902, such examinations and surveys were made of the 14 miles of channel from the main river to the Gulf as were necessary for full information relative to the depth and width of channel. Four charts showing this channel accompany a report of Mr. Cornelius Donovan, assistant engineer, herewith.

To ascertain the volume and percentage of flow through the three passes of the river, discharge measurements were taken during the high-water period of 1905. The measurements were commenced on March 10, 1905, and were still in progress at the close of the fiscal year. For full information, data, etc., concerning these measurements and the results obtained, see report of Mr. Donovan:

Statement of expenditures on account of appropriation for examinations and surveys at South Pass, Mississippi River, from July 1, 1904, to June 30, 1905, inclusive, made in compliance with the river and harbor act of June 13, 1902.

Services	$8,426.98
Board of surveying party	56.00
Total	8,482.98

Money statements.

APPROPRIATION FOR FISCAL YEAR 1904.

July 1, 1904, balance unexpended	$1,748.81
June 30, 1905, amount expended during fiscal year	1,748.81

APPROPRIATION FOR FISCAL YEAR 1905.

July 1, 1904, amount appropriated by river and harbor act of June 13, 1902, for fiscal year 1905		$10,000.00
June 30, 1905, amount expended during fiscal year	$8,482.98	
July 1, 1905, outstanding liabilities (for services)	1,517.02	
July 1, 1905, total cost of operations during fiscal year		10,000.00

REPORT OF MR. CORNELIUS DONOVAN, ASSISTANT ENGINEER.

NEW ORLEANS, LA., *July 5, 1905.*

SIR: I have the honor to report upon the work of examinations and surveys at South Pass, Mississippi River, during the fiscal year ending June 30, 1905.

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The following charts accompany this report:

No. 1. Chart of the channel from South Pass light-house through the jetties to deeper water in the Gulf.

No. 2. Chart of a part of South Pass from South Pass light-house to Grand Bayou.

No. 3. Chart of a part of South Pass from Grand Bayou to the head of South Pass.

No. 4. Chart of the Head of the Passes.

No. 5. Chart of Pass a Loutre Crevasse.

EXAMINATIONS AND SURVEYS.

A detailed annual survey was made from deep water in the Mississippi River through South Pass to deep water in the Gulf, a distance of 14 miles. (See charts Nos. 1, 2, 3, and 4.) Monthly surveys were made of the jetty channel, and weekly surveys were made of the shoaler reaches in South Pass and of the channel beyond the ends of the jetties.

A survey was made of the Pass a Loutre Crevasse. (See chart No. 5.)

All soundings from deep water in the Gulf to a point 5 miles above the South Pass light were reduced to the plane of mean low tide, which is indicated by a reading of 3.1 feet on the Port Eads gauge, and the remainder of the pass to deep water in the Mississippi River were reduced to a reading of 1.96 feet on the Head of Passes gauge, this being the mean low tide during low river.

The following table gives the least depth of water through South Pass, the jetty channel, and the channel beyond the ends of the jetties for each month of the year:

Date.	South Pass.				Jetty channel.				Beyond jetties.			
	Available depth.	Available width of channel.			Available depth.	Available width of channel.			Available depth.	Available width of channel.		
		26 feet.	28 feet.	30 feet.		26 feet.	28 feet.	30 feet.		26 feet.	28 feet.	30 feet.
1904.	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*
July	28.4	235	140	.....	30.3	200	170	50	27.2	100	.....	.....
August	28.1	265	30	.....	30.9	160	120	100	28.0	100	70	.....
September	28.3	270	90	.....	30.5	180	145	95	28.5	180	35	.....
October	28.3	280	90	.....	.....	.....	.....	.....	27.9	240	.....	.....
November	28.1	230	140	.....	29.4	160	115	.....	28.6	90	50	.....
December	28.0	230	45	.....	29.9	160	100	.....	29.2	220	140	.....
1905.												
January	28.3	290	160	.....	30.0	170	140	.....	29.5	250	110	.....
February	28.3	290	170	.....	29.4	170	145	.....	31.5	170	155	95
March	28.8	310	215	.....	30.0	210	155	.....	30.6	300	225	90
April	[a] 27.0	80	.....	.....	30.0	215	180	70	30.7	300	220	180
May	29.1	275	125	.....	29.4	215	190	.....	31.7	330	230	90
June	[a] 27.2	170	.....	.....	.....	.....	.....	.....	31.8	320	280	210

[a] The shoalings in South Pass were caused by sand waves and were of short duration, being removed in a few days by the dredge *Benyaurd*. The stage of the river at the time of the shoalings was about 2 feet above the plane of reference, making the actual available depth 29 feet.

DISCHARGE MEASUREMENTS.

To ascertain the volume and percentage of flow through South Pass, Southwest Pass, and Pass a Loutre, discharge measurements were begun on March 10, 1905. At this time the stage of the Mississippi River was 8.45 feet on the Carrollton gauge. The observations will be continued during the high-water season and until the river reaches a stage of 5 feet on the Carrollton gauge.

Location.—The South Pass discharge section is located about 200 feet above the location used in 1898, being 2,450 feet below Head of Passes light. There are six velocity stations 100 feet apart.

Southwest Pass discharge section occupies the same location and position as that used in 1898, and is located at a point 4,500 feet below Head of Passes light. There are eleven velocity stations 160 feet apart.

Pass a Loutre discharge section is located about 300 feet above the location used in 1898, being 8,000 feet below Head of Passes light. There are twelve velocity stations 200 feet apart.

Meter.—Three observations per week have been taken since March 10, 1905, using a Ritchie-Haskell current meter. The outfit is rigged on a 50-foot steam launch. Each observation is taken at six-tenths the depth of the water at each velocity station and covers a period of 200 seconds.

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Meter ratings.—The meter was rated in Red Pass, The Jump, where still water from 6 to 8 feet deep was available. The ratings were made with sufficient frequency to insure accurate results. The meter was suspended from a frame 3 feet in front of the bow of a skiff and at a depth of 3 feet below the surface of the water. The skiff was drawn forward and backward over a 200-foot base by men on shore pulling a quarter-inch line of continuous circuit reeved through four blocks. The blocks at the ends of the base were supported by buoys and stayed by anchors. The velocities used had sufficient range to cover all velocities found in the actual work.

Soundings.—The area of the cross section is determined for each observation by taking careful soundings over the section at 50-foot intervals in South Pass and Pass a Loutre and at 40-foot intervals in Southwest Pass. The locations of the soundings at the velocity stations are determined by intersecting ranges on shore, the locations of intermediate soundings being estimated by means of the shore ranges.

Gauges.—Local gauges were placed at each of the discharge sections, and all readings are reduced to mean gulf level, corresponding to a reading of 1.76 feet on Head of Passes gauge.

Results.—The computations have not been kept up to date, but enough have been computed and checked to give an approximate idea of the results.

The discharge of South Pass varies from 8 per cent to 10.7 per cent of the total volume through the three passes, with an average of 9.3 per cent. Eight and six-tenths per cent was discharged through South Pass in 1898.

Southwest Pass discharge varies from 43 per cent to 48 per cent of the total volume, with an average of 46 per cent, as compared with 41.4 per cent in 1898.

Pass a Loutre discharge varies from 42.2 per cent to 47.5 per cent of the total volume, with an average of 44.7 per cent, as compared with 50 per cent in 1898.

A tabulation of the results is appended. The results of each pass are tabulated separately, so that the results of each observation may be more easily compared.

The decrease in the amount of water carried by Pass a Loutre is probably due to one or both of two causes: (1) The mattress sill, which was placed across the pass in 1900, has probably decreased the cross section of the pass at that point and deflected some of the water into the other passes; (2) in 1898 the Pass a Loutre crevasse, which is about 1¼ miles below Head of Passes light, opened directly into Garden Island Bay, which was a wide shallow bay; the bay has been filled with sediment from the river until at present it is from 4 to 6 miles from the mouth of the crevasse to the open water in the bay, the water flowing that distance through numerous small channels. As 38 per cent of the water entering the pass in 1898 was discharged through the crevasse, any decrease in the velocity of the current due to the increased distance from the pass to the open water in the bay would affect the discharge of Pass a Loutre.

Results of discharge measurements, passes of the Mississippi River, March 10 to May 10, 1905.

Date.	Discharge in cubic feet per second.			Total discharge of river (cubic feet per second).	Percentage of total discharge.			Carrollton gauge record (feet).
	South Pass.	Southwest Pass.	Pass a Loutre.		South Pass.	Southwest Pass.	Pass a Loutre.	
1905.								
Mar. 10	53,825	253,839	251,978	559,642	9.6	45.4	45.0	8.45
13	56,063	270,848	265,829	592,740	9.5	45.7	44.8	9.45
16	65,082	289,235	259,001	613,318	10.6	47.2	42.2	10.10
17	65,787	288,857	269,998	625,642	10.7	46.2	43.1	10.20
21	72,127	334,423	301,388	707,938	10.2	47.2	42.6	11.60
24	70,005	318,716	314,941	703,662	9.9	45.3	44.8	11.90
25	75,319	329,195	308,879	713,393	10.6	46.1	43.3	11.90
28	76,829	332,042	322,377	731,138	10.5	45.4	44.1	12.10
31	72,432	341,622	318,293	732,347	9.9	46.6	43.5	12.40
Apr. 3	68,102	335,885	322,415	726,402	9.4	46.2	44.4	12.45
4	66,969	339,572	321,603	728,144	9.2	46.6	44.2	12.60
8	66,629	334,567	326,053	717,249	9.3	45.3	45.4	12.30
11	59,604	320,587	318,004	698,195	8.5	45.9	45.6	12.75
14	69,097	332,086	327,490	728,673	9.5	45.6	44.9	12.90
15	64,062	334,884	323,328	722,244	8.9	46.3	44.8	12.75
18	70,888	337,955	311,405	720,248	9.9	46.9	43.2	12.50
20	56,599	315,291	284,541	656,431	8.6	48.0	43.4	12.10
21	52,281	302,814	294,918	650,013	8.0	46.6	45.4	12.00
25	47,344	247,839	281,345	576,528	8.2	43.0	48.8	11.25
27	47,696	265,508	256,024	569,223	8.4	46.6	45.0	11.20
28	50,863	264,049	255,981	570,893	8.9	46.3	44.8	10.85
May 1	51,681	270,249	247,745	569,675	9.1	47.4	43.5	10.90
3	44,027	245,251	246,152	535,430	8.2	45.8	46.0	10.50
5	45,400	236,702	248,567	530,669	8.5	44.7	46.8	10.30
10	43,496	226,313	243,891	513,700	8.5	44.0	47.5	10.45

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NAVIGATION OF THE CHANNEL.

The channel through South Pass has remained exceptionally good throughout the year. The small shoals and sand waves that appeared in South Pass during the high water were quickly removed by the dredge *Benyaurd*. The channel beyond the ends of the jetties has been put in splendid condition; the dredge removed the mud lumps that obstructed the channel and greatly reduced the shoal to the westward of the channel.

There have been no ships aground in South Pass or deep outbound ships aground on the shoal to westward of the channel beyond the ends of the jetties during the year. Three ships, inbound, grounded at the mouth of South Pass during the year on account of fog and strong current.

Respectfully submitted.

CORNELIUS DONOVAN,
Principal Assistant Engineer.

Lieut. Col. CLINTON B. SEARS,
Corps of Engineers.

S 5.

MAINTENANCE AND IMPROVEMENT OF SOUTH PASS CHANNEL, MISSISSIPPI RIVER.

For references as to progress of the work see Annual Report of the Chief of Engineers for 1904, page 1886.

For convenience of reference the operations for the past fiscal year are given under subheadings.

MAINTENANCE OF JETTIES AND AUXILIARY WORKS.

During the year repairs were made to west dike and upper dam, at the head of South Pass; the bank below upper dam was revetted for a distance of 350 feet with stone, to prevent surface wave wash from cutting through between South Pass and Pass a Loutre, and stone was placed on the sill across the head of Pass a Loutre to hold it in place and to prevent erosion under the sill. The 37 wing dams in the jetty channel, 7 in Grand Bayou reach, 4 in Goat Island reach, and one in Port Eads reach were maintained in good condition during the year by the addition of willows, stone, piles, and waling timber, as required.

The steamship *Excelsior* ran into and damaged the inner west jetty for a distance of about 100 feet, on September 1, 1904. The damage was repaired at a cost of $162.65. The matter was reported to the United States district attorney, who collected the cost of the repairs, and the amount was deposited to the credit of the appropriation.

The inner east jetty was repaired with willows and stone for a distance of 3,265 feet, 5,777.2 cords of willows and 2,548 cubic yards of stone being used in this work.

One wharf at Port Eads was rebuilt and minor repairs made to two other wharves. Two houses were raised and repaired and repairs were made to others buildings, as required. Repairs were made to the floating plant, as required. One new barge was constructed under contract, to replace a barge worn out and unserviceable.

The total amount expended during the year in connection with maintenance of jetties and auxiliary works proper was $48,564.41.

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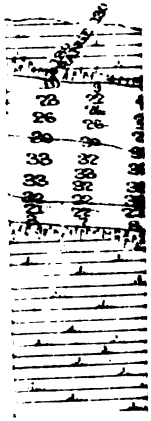

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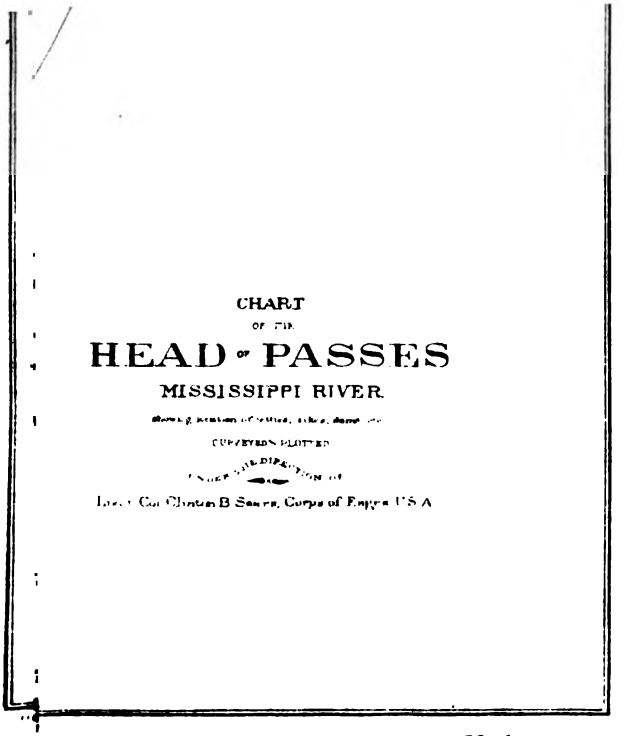

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DREDGING.

Dredge Sabine.—This dredge, belonging to the work of improving Sabine Pass, Texas, was employed temporarily in dredging in the channel beyond the ends of the jetties from July 15 to August 20, 1904. During this period the dredge removed 634 loads of material, containing an estimated total of 123,630 cubic yards of solid material. The cost of the operations of the boat during this period was $3,908.66; adding to this interest on the original cost of the dredge ($90,690) at 3 per cent, and depreciation of plant at 5 per cent per annum, the net cost of the dredging was $4,634.18, resulting in a cost to the Government of about 3¾ cents per cubic yard of solid matter removed.

Dredge Benyaurd.—This dredge, built under the direction of Maj. J. C. Sanford, Corps of Engineers, and paid for from the appropriations for improving passes of the Mississippi River and improving Southwest Pass, Mississippi River, arrived at New Orleans on October 12, 1904, and began dredging in the channel beyond the ends of the jetties at South Pass on October 24, 1904. Since that date she has been operated in South Pass and in the channel beyond the ends of the jetties, except for periods when she was undergoing repairs or coaling.

The thirty days' trial of the dredge provided for in the contract for her construction was had under the direction of Major Sanford and was completed on December 15, and the dredge was formally turned over to this district on December 17, 1904. The expenses of the dredge were paid by this office from the date of her arrival at New Orleans.

It is estimated that the *Benyaurd* has removed approximately 380,960 cubic yards of solid material since beginning work October 24, 1904, to the end of the fiscal year. The total cost of the dredge since her arrival in this district, including repairs, etc., was $39,180.65, of which amount $36,906.98 was paid from this appropriation and $2,273.67 from the appropriation for Southwest Pass. Including interest on the cost of the dredge (about $400,000) at 3 per cent and depreciation of plant at 5 per cent per annum, the cost per cubic yard of solid matter removed would be 16 cents. This amount does not, however, represent the present or future cost per cubic yard of material removed, as the cost of operation was materially greater during the first few months of work, before the dredge was got to a working basis, and considerable time was lost during the first two months on account of extraordinary repairs. The cost per cubic yard during the last two months of the fiscal year was about 11 cents.

The dredge *Barnard*, built under the direction of Major Sanford for work at Southwest Pass, was transferred to South Pass for her tests in October, 1904. On account of an accident to the pumping machinery, after five minutes' work on October 25, the dredge was returned to New Orleans for repairs. No work was done by this dredge at South Pass during the fiscal year. For operations of the dredge, see report for improving Southwest Pass, Mississippi River.

CONDITION OF THE CHANNEL.

The channel through South Pass, the jetty channel, and beyond the jetties has been exceptionally favorable during the year. Small shoals have occurred from time to time, which have, however, been removed after a few days' dredging. The only cases of grounding of vessels

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reported were three ships, inbound, running on the shoal to the we[st]ward of the channel beyond the ends of the jetties, on account of fo[g] and a strong cross current.

For details of the work and of the channel maintained see the rep[ort] of Mr. Cornelius Donovan, assistant engineer, printed below:

Money statements.

APPROPRIATION FOR FISCAL YEAR 1904.

July 1, 1904, balance unexpended	$34,135.9[9]
June 30, 1905, amount expended during fiscal year	18,955.9[9]
July 1, 1905, amount reverting to Treasury	15,179.9[9]

APPROPRIATION FOR FISCAL YEAR 1905.

July 1, 1904, amount appropriated by emergency river and harbor act of June 6, 1900	100,000.0[0]
Amount deposited to credit of appropriation January 30, 1905, by Capt. W. B. Ladue	36.7[2]
Amounts collected by United States attorney on account of damages to public works, and deposited to credit of the appropriation	269.4[9]
	100,306.1[1]
June 30, 1905, amount expended during fiscal year	86,258.1[2]
July 1, 1905, balance unexpended	14,047.9[9]
July 1, 1905, outstanding liabilities $8,210.79	
July 1, 1905, amount covered by uncompleted contracts 5,837.17	
	14,047.9[9]

ABSTRACT OF APPROPRIATIONS.

Maintenance.

By act of Congress—	
Approved June 6, 1900 (indefinite), $100,000 annually	$500,000.0
Approved June 6, 1900 (allotted)	10,000.0
Approved June 13, 1902	75,000.0
	585,000.0[0]
Amounts collected and deposited by United States district attorney for damages to public works	1,409.2[2]
Amount received from sale of Government property	11.0[0]
Amount deposited to credit of appropriation by Capt. W. B. Ladue, Corps of Engineers, January 30, 1905	36.7[2]
Total	586,457.0
Reverted to Treasury	[a]73,532.4

ABSTRACT OF CONTRACTS IN FORCE DURING FISCAL YEAR ENDING JUNE 30, 1905.

Name and address of contractor: Oscar F. Barrett, Cincinnati, Ohio.
Work: Furnishing and delivering 4,000 cubic yards, more or less, of stone on th[e] bank of South Pass, Mississippi River.
Contract price: $3.65 per cubic yard.
Date of contract: June 16, 1904.
Date of expiration: September 14, 1904.
Emergency contract.

[a] Amount given in Annual Report for 1904 as amount reverted to Treasury is incorrect

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Name and address of contractor: W. G. Coyle, New Orleans, La.
Work: Furnishing and delivering 10,000 barrels, more or less, of Pittsburg coal in the coal yard at Port Eads, La.
Contract price: 34 cents per barrel.
Date of contract: October 19, 1904.
Date of expiration and completion: October 27, 1904.
Emergency contract.

Name and address of contractor: The Johnson Iron Works (Limited), New Orleans, La.
Work: Constructing barge.
Contract price: $2,250.
Date of contract: October 3, 1904.
Date of expiration: December 3, 1904; time limit waived.
Date of completion: February 28, 1905.
Emergency contract.

Name and address of contractor: The Johnson Iron Works (Limited), New Orleans, La.
Work: Rebuilding U. S. boat *Chere Amie.*
Contract price: $13,950.
Date of contract: December 28, 1904.
Date of expiration: May 28, 1905; time limit waived.
Emergency contract; to be paid jointly from the appropriations for maintenance of South Pass channel and improving Southwest Pass, Mississippi River.

COMMERCIAL STATISTICS FROM JANUARY 1, 1904, TO DECEMBER 31, 1904.

Port of New Orleans, La.

[From information furnished by collector of port of New Orleans.]

Class.	Entered.		Cleared.	
	Number.	Tonnage.	Number.	Tonnage.
FOREIGN-BOUND VESSELS.				
Steamers	930	1,521,199	959	1,629,295
Sailing vessels	49	29,223	40	28,540
COASTWISE VESSELS.				
Steamers	282	654,084	265	575,302
Sailing vessels	12	9,513	10	4,872
Total	1,273	2,214,019	1,274	2,238,009

Foreign exports and imports.

Articles.	Year ending December 31, 1904.	
	Tons.	Value.
EXPORTS.		
Cotton	482,912	$109,238,061
Cotton-seed oil	28,675	2,233,313
Cotton-seed cake and meal	251,319	5,573,673
Corn	174,586	3,199,840
Wheat	56,732	1,554,303
Flour	61,185	2,831,381
Oats	990	29,130
Horses and mules	1,238	138,908
Leaf tobacco	23,805	4,744,308
Boards, deals, planks, etc	208,650	2,875,380
Staves	140,456	2,565,961
Lumber, manufactured	120,572	1,205,726
Lard and lard compounds	15,341	2,181,723
Beef, canned	2,031	378,152
Agricultural implements	3,368	842,090
Rosin	9,759	191,149
Turpentine	1,670	818,580
Tallow	3,749	346,463
Rice and rice bran	14,704	303,158

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Foreign exports and imports—Continued.

Articles.	Year ending December 31, 1904.	
	Tons.	Value.
EXPORTS—continued.		
Soap	1,571	$175,854
Cordage	147	30,946
Cotton cloth	3,860	96,514
Cotton, manufactures of	6,168	616,864
Miscellaneous	170,095	5,102,856
Total exports	1,783,533	146,864,298
IMPORTS.		
Coffee	85,098	13,166,801
Cement	5,460	32,686
Sugar	219,189	9,524,908
Molasses	13,993	56,350
Salt	5,572	28,971
Sisal grass	33,314	3,801,234
Fruits and nuts	201,737	3,026,055
Fibers, manufactures of	26,992	2,645,252
Chemicals, drugs, etc	9,466	444,911
Wines, liquors, etc	729	405,229
Iron and steel, manufactures of	8,665	251,292
Tobacco and cigars	50	122,014
Matting	898	35,562
Fertilizers	13,074	84,992
Earthen, glass, and china ware	2,811	281,115
India rubber, crude	236	292,145
Cotton, manufactures of	5,528	552,806
Oils	566	188,519
Sulphur ore	19,839	47,167
Mahogany logs	14,813	286,711
Spices	276	62,640
Cotton fabrics	186	69,256
Miscellaneous	4,666	466,594
Total imports	673,159	35,873,200
Total exports and imports	2,456,686	182,737,498

Domestic shipments and receipts by Southern Pacific Line of steamers (formerly Cromwell and Morgan lines).

Articles.	Year ending December 31, 1904.	
	Tons.	Value.
SHIPMENTS.		
Cotton	41,671	$8,334,200
Rice	17,099	683,960
Wool	83	24,900
Hides and leather	24	5,760
Lumber	31,753	317,530
Sugar	39,927	3,194,160
Canned goods	68	13,600
Manufactured products and merchandise	82,749	8,274,900
Iron, steel, and metals	10	500
Agricultural products	11,332	283,300
Miscellaneous	169	6,760
Total shipments	224,885	21,139,570
RECEIPTS.		
Rice	32	1,280
Lumber	227	5,675
Sugar	4,394	351,520
Canned goods	745	149,000
Manufactured products and merchandise	152,413	15,241,300
Iron, steel, and metals	2,668	667,000
Agricultural products	10,972	329,160
Miscellaneous	904	90,400
Total receipts	172,355	16,835,335
Total shipments and receipts	397,240	37,974,905

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REPORT OF MR. CORNELIUS DONOVAN, ASSISTANT ENGINEER.

NEW ORLEANS, LA., *July 5, 1905.*

SIR: I have the honor to report upon the work of maintaining the channel throughout the South Pass of the Mississippi River from the main river to the Gulf of Mexico, during the fiscal year ending June 30, 1905.

The work consisted in the maintenance of such existing jetties, dikes, dams, wharves, houses, and floating plant as were necessary.

AT THE HEAD OF SOUTH PASS.

The locations of all work in this locality are given on Chart No. 4, with report on examinations and surveys.

West dike and upper dam.—One thousand and ninety-three and four-tenths cords of willows were used in west dike and upper dam, and were compressed and held in place with earth.

Bank revetment below upper dam.—Three hundred and twenty-seven cubic yards of stone were used in revetting the bank of South Pass for a distance of 350 feet below upper dam, to prevent surface wave wash from cutting a channel through the land between South Pass and Pass a Loutre.

Pass a Loutre mattress sill.—The deep pool at the east end of upper dam worked upstream until it undermined the lower edge of the mattress sill across Pass a Loutre. Two hundred and sixty-nine cubic yards of stone were placed on the sill at that point to hold the mattresses in place and prevent further erosion. The material removed from South Pass by the dredge *Benyaurd* was dumped in that vicinity, which, together with the natural deposit from the river, has caused a shoaling of about 23 feet at the deepest point since January, 1905.

IN SOUTH PASS.

The four wing dams in sections 305–315 (Goat Island reach) and the seven wing dams in sections 155–210 (Grand Bayou reach), also the one wing dam in Port Eads reach have remained in serviceable condition during the year without any repairs having been made to them. Many of the piles will be renewed, and all the dams will be filled with willows early in the ensuing year.

AT THE MOUTH OF SOUTH PASS.

All works at this locality are shown on Chart No. 1, with report on examinations and surveys.

Main jetties.—Except for the settlement which may have taken place, there was no change in the condition of the main jetties during the year, and no work was required in connection with them.

Inner east jetty.—The maintenance of this jetty is the principal work at this locality. It was maintained by the addition of willows and stone. From a point 60 feet below Dam No. 12 up to a point 200 feet above Dam No. 21, a distance of 3,265 feet, 5,777.2 cords of willows and 2,548 cubic yards of stone were used. Twenty-eight piles were driven along the front of the jetty below Dam No. 21.

Inner west jetty.—The only work done on the inner west jetty during the year was to repair the damage done by the steamship *Excelsior* on September 1, 1904. The steamship struck the jetty about 100 feet below Dam No. 9 and damaged the piles and crib to the amount of $162.65. The following materials were used in repairing same: 4 piles, 2 waling timbers, 20 bolts, and 20 cubic yards of stone.

Wing dams.—There are 37 wing dams in the jetty channel. Dams Nos. 1, 33, 48, and 50 were repaired during the year, the following materials being used: 26 piles, 6 waling timbers, 38 bolts, and 65 cords of willows. All of the dams are in serviceable condition.

DREDGING.

The dredge *Sabine* worked twenty-nine days in the channel beyond the ends of the jetties, from July 15 to August 20, 1904.

The dredge *Benyaurd* arrived at Port Eads, La., on October 24, 1904, and began work in the channel beyond the ends of the jetties. Since that date the dredge has worked fifty-six and one-half days in the channel beyond the ends of the jetties and eighty and one-half days in the shoaler reaches in South Pass. The channel beyond the ends of the jetties was deepened from 27.9 feet to 31.8 feet, and the channel through South Pass has varied from 27 feet to 30 feet.

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THE PLANT.

Wharves and buildings.—Wharf A (mooring wharf at shops) was rebuilt and wharves B and C were filled on the shore side with sand. Houses Nos. 7 and 14 were raised and repaired. New shingles were put on houses Nos. 7, 10, and 19, and minor repairs were made to houses Nos. 17 and 20. Buildings Nos. 1, 2, 4, 5, 7, 9, 10, 12, 14, 17, 18, and 19 were painted. Elevated bins for coaling the dredge *Benyaurd* have been designed and are under construction.

Floating plant.—The floating plant consists of 1 tug, 1 steam launch, 1 pile driver, 1 derrick boat, 8 barges, 1 yawl boat, and 5 skiffs. Barge No. 6 became unserviceable and was replaced by a new barge built by The Johnson Iron Works (Limited), of New Orleans, La. The tug and launch were docked and painted, and the necessary repairs made to keep them in good condition. The barges and skiffs have been painted and minor repairs made to same. The pile driver is in need of new leads and minor repairs to hull. The machinery on the derrick boat is worn out and will be replaced by new machinery.

THE FORCE EMPLOYED.

The permanent force consists of 2 junior engineers, 1 overseer, 1 master, 3 steam engineers, 1 carpenter, 1 stoker, 1 leadsman, 4 deck hands, 1 gauge observer, and 1 watchman, being 16 in number. This force was increased at times, as occasion demanded, by recorder, carpenters, and calkers. The laboring force averaged 15 men.

The following table shows the distribution of labor during the year:

Where employed.	Hours.
Upper dam, Head of Passes	914
West dike, Head of Passes	1,438
Revetting bank below upper dam, Head of Passes	596
Placing stone on Pass a Loutre mattress sill	376
Repairing inner east jetty	12,982
Repairing inner west jetty	118
Repairing dams in jetty channel	442
Repairing coal-yard wharf and driving dolphins	1,522
Rebuilding mooring wharf	745
Filling behind wharves	384
Driving mooring piles for plant	233
Cutting willows at Head of Passes	2,016
Cutting grass and cleaning premises	1,923
Repairing houses	3,921
Repairing plant	674
Painting houses and plant	1,128
Coaling dredge Benyaurd	1,752
Building coal chute	399
Clearing lines for level party	272
Putting piles on shore and storing lumber	206
Repairing plank walks	58
Docking and repairing launch Ubsdell	48
Breaking up old coal barge	321
Unloading ballast from ships	153
Driving piles at Fort St. Philip, La	120
Extra labor on tug Startle	224
Extra labor on launch General Reese	1,050
Labor lost on account of bad weather	1,763
Total	35,773

Respectfully submitted.

CORNELIUS DONOVAN,
Principal Assistant Engineer.

Lieut Col. CLINTON B. SEARS,
Corps of Engineers.

S 6.

IMPROVEMENT OF BAYOU LAFOURCHE, LOUISIANA.

No work was done during the past fiscal year, as a dam has been constructed across the head of the bayou by State levee boards, under authority of act of Congress approved June 13, 1902. No estimate

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for additional funds for this improvement is submitted, as the time for the removal of the dam has been extended to December, 1907, by joint resolution of Congress approved April 13, 1904.

The expenditures during the year were for expenses incurred in the collection of commercial statistics.

Money statement.

July 1, 1904, balance unexpended	$2,059.26
June 30, 1905, amount expended during fiscal year	50.00
July 1, 1905, balance unexpended	2,009.26

ABSTRACT OF APPROPRIATIONS.

By act of Congress—		By act of Congress—	
Approved June 13, 1878	$10,000	Of August 18, 1894	$40,000
Approved March 3, 1879	10,000	Passed June 3, 1896	25,000
Approved June 14, 1880	5,000	Approved March 3, 1899 (maintenance)	7,500
Approved July 5, 1884	5,000	Approved June 13, 1902 (maintenance)	7,500
Of August 11, 1888	50,000		
Approved September 19, 1890	50,000		
Approved July 13, 1892	50,000	Total	260,000

COMMERCIAL STATISTICS.

[From January 1, 1904, to December 31, 1904, inclusive.]

Vessels entering and departing.

	Number.	Trips.	Net registered tonnage.
Steamers	2	158	9,350
Sailing vessels	20	250	2,500
Barges	14	562	123,755
Total	36	970	135,605

Draft of heaviest vessel: Light, 2 feet; loaded, 7 feet.

Shipments and receipts by water.

Articles.	Tons.	Value.
SHIPMENTS.		
Merchandise	1,785	$133,875
Cotton	250	60,000
Vegetables	9,507	294,717
Molasses	8,934	303,756
Sugar	14,225	1,138,000
Total	34,701	1,930,348
RECEIPTS.		
Fuel oil	23,587	138,239
Merchandise	8,551	635,225
Total	32,138	773,464
Grand total	66,839	2,703,812

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S 7.

IMPROVEMENT OF BAYOU PLAQUEMINE AND GRAND RIVER AND PIGEON BAYOUS, LOUISIANA.

For a detailed record of the improvements see references cited on page 1895 of the Annual Report of the Chief of Engineers for 1904.

For convenience of reference the operations are given under subheadings.

LOCK AND APPROACHES.

No work on the lock had been done at the beginning of the fiscal year since November 15, 1900, when work under the contract with Stewart & Co. for construction of the lock and approaches was suspended. In order to provide for the resumption of work, the lock pit was cleaned out and concrete placed to complete the lock walls. This work was commenced October 29, 1904, and completed January 10, 1905, the work being done by hired labor. A total of 800 cubic yards of concrete was placed, and everything put in readiness for work to be commenced by the contractors for the lock gates and for the power house and operating machinery. The sum of $6,188.26 was expended for this purpose.

Construction and erection of the lock gates.—The shop drawings of the contractors, the Penn Bridge Company, of Beaver Falls, Pa., were approved in August, 1904, and the contractors began the shop work in September, 1904. The assembling of plant, etc., on the ground was commenced in December, 1904, and work on the alteration of the miter sills in January, 1905. At the close of the fiscal year the guard gate and the two lower main lock gates had been practically completed, and two leaves of one of the upper gates and one leaf of the remaining gate had been assembled, but not riveted. At the close of the fiscal year the erection of the gates was approximately 75 per cent completed. A total of $91,497.25 was expended in connection with work on the lock proper during the fiscal year, not including retained percentages or outstanding liabilities.

Power house and operating machinery.—This contract was entered into on November 18, approved December 30, 1899, with the Otis Elevator Company, of New York City, work to be completed within six months after notice to commence was given. No work was done under this contract during the period in which work on the lock was suspended, and notice to commence was not given until July 23, 1904. Detail plans were submitted and approved and work on the ground was commenced in February, 1905. To the end of the fiscal year the steam pumps and accumulator, two boilers, five cylindrical valves, air compressor, water tanks, and a part of the hydraulic piping had been placed in position, pipe connections made, etc.; the hydraulic capstans and remainder of the machinery had been shipped, and the material for the power house was being assembled on the lock wall. No expenditures were made in connection with this work during the year, as the contract provides that no payment shall be made the contractors until the plant has been completed and satisfactorily tested.

Protection levee and fill.—Proposals for constructing protection levee from the southeast corner of the lock to connect with the State levee system and to fill in behind the walls of the lock for a distance of 100 feet from the river end, the whole work to include the placing

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of about 40,000 cubic yards of earth, were opened on December 15, 1904. As the lowest bid received was informal, and the next lowest in excess of the amount available for the work, all bids were rejected and the work readvertised. Bids were again opened on January 24, 1905, and contract entered into with McGee & Co., of Kansas City, Mo., on February 13, the price being 59 cents per cubic yard. Work under the contract was commenced in March, 1905, and to the end of the fiscal year 16,200 cubic yards of earth had been placed. The sum of $8,241.60 was expended during the fiscal year in connection with work under this contract.

Excavation and construction of approaches.—Proposals were opened on May 29, 1905, for excavation and construction of the approaches at the bayou end of the lock and for a portion of the approach work at the river end. Contract was entered into with W. O. Burton & Co. on June 6, approved June 19, 1905. No work under this contract had been done to the end of the year.

A dike was constructed by hired labor across Bayou Plaquemine at the line of separation of the excavation work in connection with the bayou approach to be done dry and of the work to be done by dredging The cost of this dike was $534.36.

Upon the completion of the lock gates and the operating machinery the test of the machinery and gates will be made. If satisfactory, provision will then be made for expending the unallotted balance of this appropriation in completion of the river approach and opening the lock to navigation.

DREDGING IN BAYOU PLAQUEMINE.

Work under the contract with Charles Clarke & Co., of Galveston, Tex., for enlarging the bed and rectification of Bayou Plaquemine, was continued during the year. Considerable trouble was experienced in placing the material in the dumping ground provided by the contract and for securing a suitable plant for handling the dredged material. A total of 95,400 cubic yards of material was removed, in accordance with the terms of the contract, to April, 1905, when the method of work was modified, as indicated below.

Under supplemental contract approved November 14, 1904, certain portions of the channel which had shoaled were redredged to specified depth and width. A total of 16,500 cubic yards of material was excavated under this supplemental contract.

By supplemental contract approved April 11, 1905, the contract was modified to permit the contractors to dredge a partial channel 50 feet wide and 8 to 10 feet deep up to the dike constructed across the bayou, mentioned above; upon completion of the partial channel, work to be suspended until the lock is open to navigation, when work will be resumed and the channel completed to full depth and width. In addition, the contractors undertake to dredge the channel from the railroad bridge to the concrete end of the bayou approach to the lock at the original contract price, 13.98 cents per cubic yard, this additional work involving the removal of about 80,000 cubic yards of material. Work on the partial channel was commenced on April 11 and completed on June 27, 1905.

In connection with dredging in Bayou Plaquemine, the sum of $8,241.60 was expended during the fiscal year.

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Attention is invited to the report of Mr. J. I. Conklin, assistant engineer, below, which is in detail and complete.

For maintaining the dredged channel through Bayou Plaquemine and Grand River, and for removing sediment from the lock chamber, a dredge should be constructed for use in connection with this improvement. It is believed that $100,000 could be advantageously expended in this connection, as follows:

Cost of dredge	$60,000
Operating same, two years at $15,000 per year	30,000
Contingencies, etc	10,000
Total	100,000

Money statement.

July 1, 1904, balance unexpended		$571,258.08
Amount appropriated by river and harbor act approved March 3, 1905		35,000.00
		606,258.08
June 30, 1905, amount expended during fiscal year, for works of improvement		122,826.96
July 1, 1905, balance unexpended		483,431.12
July 1, 1905, outstanding liabilities		38,097.08
July 1, 1905, balance available		445,334.04
July 1, 1905, amount covered by uncompleted contracts		344,074.23
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905		100,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

ABSTRACT OF APPROPRIATIONS.

By act of Congress:	
Of August 11, 1888	$100,000
Approved September 19, 1890	100,000
Approved July 13, 1892	150,000
Of August 18, 1894	110,000
Of June 3, 1896	20,000
By sundry civil act approved:	
June 4, 1897	350,000
March 3, 1899	400,000
June 6, 1900	200,000
March 3, 1901	210,000
By act of Congress:	
Approved March 3, 1905	35,000
Total	1,675,000

ABSTRACT OF CONTRACTS IN FORCE DURING THE FISCAL YEAR ENDING JUNE 30, 1905.

Name and address of contractor: Otis Elevator Company, New York, N. Y.
Work: Constructing operating machinery and power house for lock.
Contract price: $114,000, to be paid on completion and acceptance of work.
Date of contract: November 18, 1899.
Date of approval: December 30, 1899.
Date of commencement: Notified to commence work on July 23, 1904.
Date of expiration: January 23, 1905; time limit waived.

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Name and address of contractor: Charles Clarke & Co., Galveston, Tex.
Work: Dredging to enlarge bed of Bayou Plaquemine from the railroad bridge to deep water below Dardennes Bend. Estimated amount of material to be removed, 1,027,509 cubic yards.
Contract price: 13.98 cents per cubic yard.
Date of contract: July 15, 1899.
Date of approval: September 13, 1899.
Date of commencement: November 12, 1899.
Date of expiration: June 30, 1901; extended to June 30, 1902; time limit waived.

Name and address of contractor: Charles Clarke & Co., Galveston, Tex.
Work: Redredging certain portions of dredged channel through Bayou Plaquemine which had shoaled; amount of material to be removed, 16,500 cubic yards.
Contract price: 13.98 cents per cubic yard.
Date of contract: October 31, 1904.
Date of approval: By the Chief of Engineers, November 11, 1904; by the Secretary of War, November 17, 1904.
Date of completion: January 9, 1905.
Supplemental contract.

Name and address of contractor: Charles Clarke & Co., Galveston, Tex.
Work: Provides for modification of method of work on contract of July 15, 1899, for enlarging bed of Bayou Plaquemine and for certain additional work, no change in contract price being involved. Estimated number of additional cubic yards of material provided for by this supplemental contract, 80,000.
Date of contract: March 30, 1905.
Date of approval: By the Chief of Engineers, April 11, 1905; by the Secretary of War, April 11, 1905.
Supplemental contract.

Name and address of contractor: Penn Bridge Company, Beaver Falls, Pa.
Work: Constructing lock gates, Plaquemine, La.
Date of contract: February 8, 1904.
Date of approval: February 19, 1904.
Date of commencement: May 23, 1904.
Date of expiration: August 23, 1905.

Items.	Approximate quantities.	Prices.	Amounts.
Rivet steel ..... pounds..	105,000	$0.068	$7,140.00
Soft steel ..... do....	1,732,000	.068	117,776.00
Medium steel ..... do....	20,870	.10	2,087.00
Cast steel ..... do....	116,496	.085	9,902.16
Cast iron ..... do....	4,400	.08	352.00
Bronze ..... do....	1,320	.60	792.00
Iron pipe for walk ..... linear feet..	1,565	.12	187.80
Timber for walk ..... feet B. M..	1,273	60.00	76.38
Sluice valves for gates ..... number..	16	85.00	1,360.00
Completing miter sills ..... do....	5	450.00	2,250.00
Forged steel ..... pounds..	1,000	.105	105.00
Total	.....	.....	142,028.34

Name and address of contractor: McGee & Co., Kansas City, Mo.
Work: Constructing levee and making fill behind walls of the lock; estimated amount of earth to be placed, 40,000 cubic yards.
Contract price: 59 cents per cubic yard of earth placed.
Date of contract: February 13, 1905.
Date of approval: February 17, 1905.
Date of commencement: April 18, 1905.
Date of expiration: August 18, 1905.

Name and address of contractor: W. O. Burton & Co., New Orleans, La.
Work: Excavation and construction of approaches to the lock.
Date of contract: June 6, 1905.
Date of approval: June 19, 1905.
Date of commencement: August 19, 1905.
Date of expiration: January 19, 1906.

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Items.	Estimated quantities.	Prices.	Amounts.
50-foot piles.....number..	1,650	$12.50	$20,625
35-foot piles.....do....	2,100	8.75	18,375
Excavation.....cubic yards..	40,000	.40	16,000
Concrete.....do....	10,000	5.50	55,000
Snubbing posts.....number..	11	20.00	220
Total.....			110,220

COMMERCIAL STATISTICS FROM JANUARY 1, 1904, TO DECEMBER 31, 1904.

Vessels entering and departing.

Number	170
Net registered tonnage	4,075
Draft of heaviest vessels:	
Light.....feet..	6
Loaded.....do....	9½

Shipments and receipts by water.

Articles.	Tons.	Value.
SHIPMENTS.		
Lumber, as logs	140,000	$2,500,000
Merchandise	75,000	1,900,000
Sugar cane	40,000	160,000
Total	255,000	4,560,000
RECEIPTS.		
Coal and fuel oil	50,000	200,000
Merchandise	13,000	610,000
Total	63,000	810,000
Grand total	318,000	5,370,000

REPORT OF MR. J. I. CONKLIN, ASSISTANT ENGINEER.

PLAQUEMINE, LA., *June 30, 1905.*

SIR: I have the honor to submit the following report of the work under appropriations for "Improving Bayou Plaquemine and Grand River, Louisiana," for the fiscal year ending June 30, 1905:

CONTRACTS IN FORCE DURING THE FISCAL YEAR ENDING JUNE 30, 1905.

Penn Bridge Company: Constructing lock gates.

Otis Elevator Company: Constructing power house and operating machinery.

Charles Clarke & Co.: Widening and deepening Bayou Plaquemine, between railroad bridge at Plaquemine, and Dardennes Bend, a distance of 5.08 miles.

McGee & Co.: Constructing protection levee and making back fill.

W. O. Burton & Co.: Constructing approaches, Plaquemine, La.

Plaquemine lock.—On July 1, 1904, the condition of the Plaquemine lock was practically the same as when the work was abandoned by Stewart & Co., and as described in the last annual report.

The prospective early renewal of the work on this project caused to be placed at the bayou end of the lock a pumping plant to take out the water accumulated there during the interim. It was found that about 6 inches of silt had been deposited on the floor of the lock.

In order to clean up the lock pit and to place the concrete in the recesses left by Stewart & Co., for the hydraulic engines' foundations, an allotment was made of $6,000 to do this work with hired labor. The materials were obtained and work commenced on August 1, 1904.

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The lock pit was cleaned out and drained, the forms for placing concrete erected, and 800 cubic yards of concrete were placed, everything being put in condition for the Penn Bridge Company and the Otis Elevator Company to commence their contracts.

Penn Bridge Company.—The shop drawings made by the Penn Bridge Company for the Plaquemine lock gates were approved in August, 1904, and the contractors began the shop work in September, 1904. The first gate was assembled in their shops in November, 1904, and the first shipment of material from Beaver Falls was made November 11, 1904.

The contractor arrived on the site of the lock December 1, 1904, and began getting ready for the work of actual construction, such as sidings, derricks, and false works. The false works used in construction consist of a Howe truss that spans the lock chamber, from which the material, placed on the lock floor by means of derricks, is lifted and held in position while being assembled.

The gate proper consists of a quoin and miter post joined by horizontal circular girders spaced approximately 3 feet apart, and supported one above the other by upright diaphrams, riveted to the girders. On each side of the gate is a sheathing or skin plate which receives and transmits the water pressure from the downstream side. The sheathing on the upstream side has manholes cut into each compartment, freely admitting the water.

The quoin posts and miter posts were each constructed in one piece in the shops, and the method of erection of the gate is to lift and anchor in position the two posts and proceed from the bottom with the girders, diaphrams, and sheathing plates as they occur, one above the other, and after the material is bolted firmly in place it is followed by the riveting. The gates are 2 feet 6 inches by 31 feet 3 inches by 51 feet 6 inches high.

After the workmen became accustomed to the work it required about ten days to erect one leaf of the large main gates and about twenty days to complete the riveting. The material fitted together nicely, and all the work shows careful bending, fitting, and assembling in the shop of the various shapes that go to make up the complete structure. The riveting is all done with pneumatic hammers, which form a neatly turned hemispherical head.

Miter sills.—The cutting out of a rabbet in the granite miter sills and fitting over the anchor bolts an oak cushion forming the contact on the sill was a part of this contract. The work was done very neatly by the use of pneumatic drills, splitting the block by the use of plug and feather, leaving very little trimming for the stonecutter to prepare the sills for the reception of the oak cushion.

The following is a statement of work done during the present fiscal year:

1905.	Rivet steel.	Soft steel.	Forged steel.	Cast steel.	Miter sills completed.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	
January	.....	.....	.....	.....	1
February	.....	.....	.....	.....	2
March	.....	338,600	4,530	34,400	.....
April	.....	416,800	3,020	37,550	.....
May	.....	410,500	3,100	38,100	.....
June	31,000	205,100	1,600	20,100	.....

At the close of the fiscal year the Penn Bridge Company have practically completed the guard gate and two lower main lock gates and have assembled three halves of the two upper gates, but have done no riveting on the upper gates. The adjusting of the gates to the miter sill and contact plates is not yet done. It is estimated that their contract is 75 per cent completed.

Otis Elevator Company.—The contract for the construction of power house and installation of operating machinery was made with the Otis Elevator Company in November, 1899, and some plans were made by the contractor to execute their contract.

The plant provides for the operation of the gates by direct-connected hydraulic engines, the whole swing of the gate to be made with one stroke of the piston. The pressure to be piped to the eight hydraulic engines from a central accumulator, supplied and operated by steam pumps.

The small engines for operating the cylindrical valves for filling and emptying the lock are provided for in the same manner.

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The house is to be erected over the central plant, serving the double purpose of power house and office building.

During the delay in the lock work they were notified to suspend all operations until further notice.

On July 23, 1904, they were notified to proceed with their contract, and immediately began toward that end. At the end of the present fiscal year they have on the ground and in process of erection the following materials:

Two 100-horsepower locomotive boilers and connections.
Two Worthington steam pumps and parts.
One Worthington steam accumulator.
One duplex air compressor and parts.
Four main operating cylinders and hydraulic pipe and fittings.
Ten cylindrical valves.
All steam and exhaust pipe and fittings.
All the trench plates.
Two carloads of enameled brick for power house.

Their erecting engineer arrived on the ground on February 14, 1905, and began work at once on the erection of the above machinery, which is progressing as follows:

The steam pumps and accumulator have been placed on their foundations, all steam exhaust and water connections made to same, and are about 80 per cent completed.

The two 100-horsepower boilers have been placed in position, a part of the steam and water piping and trimmings connected to them, and are about 50 per cent completed.

A part of the hydraulic piping has been placed in position, leveled, braced, and painted, and given a preliminary test of 1,000 pounds per square inch, and is about 50 per cent completed. A part of the trench plates covering this piping has been placed, and is about 40 per cent completed.

Five cylindrical valves for filling and emptying the lock are in position, and the cast-iron pipe extending from the top of these valves to the cylinders is in place, the valve arrangement being about 20 per cent completed.

The duplex air compressor, air and water tanks are in position, together with all steam and exhaust piping and a part of the air piping.

The 8-inch well is down to the required depth, has been tested and found to give a good supply of water, and is about 80 per cent completed.

The hydraulic capstans have been shipped, and the remainder of the machinery is on the way. The material for the power house is also being accumulated.

Under the terms of this contract no payment is made until the whole plant has undergone a satisfactory test. The conditions for this test are being provided for, so it can take place on the completion of the plant.

McGee & Co.—In order to make the gate test it was necessary to have done a certain amount of earthwork, viz, building the connecting levee on the south side of the river approach and filling behind the lock wall adjacent to this levee and the levee already built for a distance of 100 feet, comprising in all approximately 40,000 cubic yards of earth. Bids were received for this work and a contract awarded to McGee & Co. on February 13, 1905.

According to the terms of this contract the only earth furnished by the United States was on the batture directly across the river from the site of the lock. The contractor preferred buying an adjacent piece of land and using the earth from the area purchased, no objection being made to this method of executing the contract.

In March, 1905, a steam shovel, locomotive, and cars were brought to the site of the work and preparation made to do the work on the north side of the lock. Also a wheel-scraper outfit was placed on the connecting levee on the south side of approach April 10, 1905. The work with the steam shovel was abandoned in May and a wheel-scraper outfit placed on the north side of approach. At present the contractor is laying a track around the bayou end of the lock to place the fill in the southeast corner of the lock behind the wings. The following is a summary of the work so far accomplished:

	Cubic yards.
April	7,500
May	5,500
June	3,200

The completion of this contract will, when the gates are completed, form a basin that can be filled with water to make the gate tests.

Dike at bayou end of lock.—In order to provide against possible encroachments of high water in Bayou Plaquemine, such as occurred in 1903, when the old dike was overtopped, flooding the lock pit, and to establish a new line of separation of the wet

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and dry earthwork at the bayou end of the lock, an allotment of $600 was made in March, 1905, to build a new dike and to provide for the necessary piping to carry the discharge from the pumps over the new dike.

A force of ten laborers was employed on this work, and the work completed in April within the allotment.

New pumping plant.—In the contract made with McGee & Co., the United States agreed to do the pumping required to take the water from the area behind the lock walls. Bids were invited, and the work awarded to H. Nadler to furnish and install a steam pump with 8-inch suction and 6-inch discharge, with necessary pipe and fittings, for the sum of $1,295.

The installation of the plant was finished May 10, 1905, and on satisfactory running test of six hours was accepted.

W. O. Burton & Co.—The completion of the new dike separating the dredging from the work necessary to be done dry, made it possible to provide for part of the approach work to be done before filling the fore bay for the gate test, and bids were invited for the construction of the approaches at the bayou end of the lock, and part of the work at the river end of the lock.

This contract carries with it the following items: 40,000 cubic yards excavation; 10,000 cubic yards of concrete; 1,650 50-foot piling; 2,100 35-foot piling; 11 snubbing posts.

Bids were opened May 29, 1905, and the contract awarded to W. O. Burton & Co., on June 19, 1905. On July 1, 1905, there had been no work under this contract.

Dredging in Bayou Plaquemine.—Charles Clarke & Co., contractors.

There is included in the contract for the rectification of Bayou Plaquemine, 1,027,509 cubic yards of excavation, and up to July 1, 1904, there had been taken out 411,230 cubic yards. There has been employed on this work during the year three dredges, the clam-shell dredges *Gen. C. M. Shelley* and dredge *No. 1*, and dredge *No. 8*, a suction dredge.

The excavation from the channel has all been done by the dredge *Shelley* into dump scows, that were towed to the dumping grounds. The other two dredges were used to rehandle the dumped material.

During the month of July and up to August 11, 1904, the dredged material was taken to Dardennes Bend and dumped in the channel and there rehandled with *No. 1* into a chute, carrying it over behind dikes constructed across the mouth of Dardennes Bend. At this time conditions were such that no more earth could be deposited in this manner with the plant then available, and permission was obtained by the contractor to deposit the material in deep water below Dardennes Bend, pending the arrival of suction dredge *No. 8*, that was designed to dump the material into the bend.

Dredge *No. 8* arrived on the work in September, but in an incomplete condition, and it was found that changes would have to be made in its mechanism to accomplish the work it was intended to do, and the permission to deposit the material in deep water below was extended.

On December 3, 1904, dredge *No. 8* burned all her superstructure, but was rebuilt at once and was placed in successful operation in March, 1905.

There has been made during the year two supplemental contracts with Charles Clarke & Co., the first to redredge a portion of the channel from section B, line 18–19, to section E, line 19–20, a distance of 1,800 feet, carrying 16,500 cubic yards of excavation, at the original contract price of $0.1398 per cubic yard. The second was an agreement made with the contractors to complete the channel to station (15) from the lower end of the work, then dredging a temporary channel, without compensation, from the new dike at the bayou end of the lock 50 feet wide with a minimum depth of 8 feet to connect with the completed work at station (15), and then suspending all operations until the opening of the lock, when the original channel should be completed, carrying the material out into the Mississippi River; also adding to the original contract, the material between the new dike and the Texas and Pacific Railroad bridge included between established harbor lines, including approximately 70,000 cubic yards of excavation at the original contract price of $0.1398 per cubic yard.

The work on the last supplemental agreement was commenced April 20, 1905, and the temporary channel was completed June 27, 1905, and the dredging operations were suspended pending the opening of the lock.

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1904.	Excavation original contract.	First supplemental contract.	Second supplemental contract.
	Cubic yards.	*Cubic yards.*	
July	17,500	.....	
August	16,000	.....	
September	5,500	.....	
October	10,700	.....	
November	2,200	.....	
December	.....	13,500	
January	.....	.....	
February	24,000	.....	
March	9,500	8,000	
April	10,000	.....	
May	.....	.....	Dredging temporary channel.
June	.....	.....	

The work necessary for the completion of the lock project not provided for by contract is the excavation and construction of the approach at the river end of the lock, carrying with it the following approximate items: 170,000 cubic yards of excavation, 4,000 50-foot piling, and 7,500 cubic yards of concrete, at an estimated cost of $160,000. Provision for this work can be made as soon as the preliminary test of the gates is completed.

Very respectfully, your obedient servant,

J. I. CONKLIN,
Assistant Engineer.

Lieut. Col. CLINTON B. SEARS,
Corps of Engineers.

S 8.

IMPROVEMENT OF BAYOU TECHE, LOUISIANA.

For references as to the progress of the work see page 1901 of the Annual Report of the Chief of Engineers for 1904.

The river and harbor act of March 3, 1905, made an appropriation of $7,500 for this work, and directed that a resurvey be made of the project submitted in House Document No. 69, Fifty-fifth Congress, first session. The project referred to contemplates securing a low-water channel of 6 feet from St. Martinville to the source of the bayou, a distance of approximately 50 miles.

A survey party left New Orleans on June 4, arriving at the head of the bayou on June 6. Field work was commenced on June 7. To the end of the fiscal year the following work had been accomplished: A stadia survey of the banks, the topography within 500 feet of the banks, and cross sections of the stream were completed along Bayou Courtableau for 1 mile on either side of the head of Bayou Teche; an azimuth line, the topography along either bank, cross sections of the stream every 1,000 feet, and level bench marks every mile have been completed along Bayou Teche for 25¼ miles from its source; gauges have been established at Port Barre, Arnaudville, and St. Martinville, and daily readings are recorded.

Bayou Teche is an important commercial stream of southern Louisiana, and is the waterway for shipping for the numerous sugar, rice, and cotton plantations located along its banks. With the exception of snags, the channel is in a fairly good condition below New Iberia, but of late years it has shoaled considerably between New Iberia and St. Martinville, and is not navigable above the latter point except during

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high-water stages. The improvement of channel accomplished will not be a permanent one, as sunken logs and fallen trees are constantly forming obstructions which will require removal, and the large drainage ditches emptying into the bayou form shoals at their mouths.

It is believed that $10,000 can be advantageously expended during the ensuing fiscal year in dredging and removing obstructions from the channel.

Money statement.

July 1, 1904, balance unexpended	$0.00
Amount appropriated by river and harbor act approved March 3, 1905	7,500.00
June 30, 1905, amount expended during fiscal year, on resurvey of bayou	457.78
July 1, 1905, balance unexpended	7,042.22
July 1, 1905, outstanding liabilities	747.15
July 1, 1905, balance available	6,295.07
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	10,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

ABSTRACT OF APPROPRIATIONS.

By act of Congress—		By act of Congress—	
Approved July 11, 1870	$17,500	Approved March 3, 1899	$10,000
Approved June 14, 1880	6,000	Approved June 13, 1902 (maintenance)	7,500
Approved March 3, 1881	20,000	Approved March 3, 1905 (maintenance)	7,500
Approved July 5, 1884	6,500		
Approved September 19, 1890	5,000		
Passed August 18, 1894	6,000		
Passed June 3, 1896	10,000	Total	96,000

COMMERCIAL STATISTICS.

[From January 1, 1904, to December 31, 1904, inclusive.]

Vessels entering and departing.

	Number.	Trips.	Net registered tonnage.
Steamers	59	861	89,326
Sailing vessels	20	720	3,600
Barges	70	2,342	375,630
Total	149	3,923	468,556

Draft of heaviest vessel: Light, 2 feet; loaded, 7 feet.

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Shipments and receipts.

Articles.	Tons.	Value.
SHIPMENTS.		
Lumber	14,458	$78,832.16
Merchandise	9,470	91,415.00
Cotton	1,086	213,450.00
Cotton-seed products	6,187	102,747.00
Rice	2,940	113,081.50
Sugar	41,971	3,357,680.00
Sugar cane	59,000	236,500.00
Molasses	7,196	244,664.00
Total	142,303	4,438,369.66
RECEIPTS.		
Lumber	147,767	562,006.95
Machinery	1,438	133,300.00
Fuel oil	52,700	262,000.00
Fertilizer	1,080	21,600.00
Coal	5,400	30,000.00
Cooperage	3,398	56,067.00
Merchandise	8,620	607,256.00
Total	220,403	1,672,229.95
Grand total	362,706	6,110,599.61

S 9.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

An allotment of $25 was made on August 16, 1904, from the indefinite appropriation for this purpose for the examination of wrecks of three unnamed coal barges in Bayou Teche, Louisiana. It having been found by examination that the wrecks of the barges were obstructions to navigation, allotments aggregating $600 were made on August 29 and October 27, 1904, to be applied to the removal of same. Bids for removing the wrecks were opened on October 17, 1904, and contract entered into with C. A. Barbour, of Franklin, La., for the work. The wrecks were removed by use of dynamite and block and tackle, the débris being disposed so as not to obstruct navigation, the work being commenced on December 8 and completed on December 15, 1904. The total cost of the operations was $625.

CONTRACT.

Name and address of contractor: C. A. Barbour, Franklin, La.
Work: Removing wrecks of three coal barges in Bayou Teche, La.
Contract price: $465.
Date of contract: November 14, 1904.
Date of approval: November 23, 1904.
Date of commencement: December 8, 1904.
Date of completion: December 15, 1904.

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APPENDIX T.

IMPROVEMENT OF HOMOCHITTO RIVER, MISSISSIPPI, AND OF CERTAIN RIVERS AND HARBORS IN SOUTHERN LOUISIANA AND EASTERN TEXAS.

REPORT OF CAPT. J. F. McINDOE, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1905, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Homochitto River, Mississippi.
2. Bogue Chitto, Chefuncte River and Bogue Falia, Tickfaw River and tributaries, and Amite River and Bayou Manchac, Louisiana.
3. Channel, bay, and passes of Bayou Vermilion and Mermentau River and tributaries, Louisiana.
4. Mouth and passes of Calcasieu River, Louisiana.
5. Johnsons Bayou, Louisiana.
6. Mouths of Sabine and Neches rivers, Texas.
7. Sabine River, Texas.
8. Harbor at Sabine Pass, Texas.
9. Removing water hyacinths from Louisiana waters.

UNITED STATES ENGINEER OFFICE,
New Orleans, La., July 19, 1905.

GENERAL: I have the honor to submit herewith annual report of operations for works of river and harbor improvement under my charge at this office for the fiscal year ending June 30, 1905.

Very respectfully, your obedient servant,

J. F. McINDOE,
Captain, Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

T 1.

IMPROVEMENT OF HOMOCHITTO RIVER, MISSISSIPPI.

For history of this work, project, and results accomplished, see current summary, page 365, also Annual Reports of the Chief of Engineers for 1899, page 1862, and 1903, page 1299.

No operations were carried on during the fiscal year ending June 30, 1905, on account of inadequacy of available funds and high stage of river.

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The project approved April 7, 1905, provides for the removal of obstructions in the river from its mouth at its junction with the Mississippi River as far up as available funds will permit. The stage of the river has remained too high for the commencement of the work.

Money statement.

July 1, 1904, balance unexpended	$423.10
Amount appropriated by river and harbor act of March 3, 1905	2,000.00
July 1, 1905, balance unexpended	2,423.10
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to balance unexpended July 1, 1905	2,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of river and harbor act of 1899.

ABSTRACT OF APPROPRIATIONS.

By act of Congress:	
Approved March 3, 1899	$16,000
Approved June 13, 1902 (maintenance)	2,000
Approved March 3, 1905 (maintenance)	2,000
Total	20,000

COMMERCIAL STATISTICS.

No detailed commercial statistics were available for the calendar year ending December 31, 1904. Circular letters and blank forms for furnishing statistics were sent in March, 1905, to all parties known to operate boats, etc., on this stream, but no satisfactory replies were received. The commerce consists mainly in the rafting of timber, although steamers make occasional trips during high water for cotton and cotton seed.

T 2.

IMPROVEMENT OF BOGUE CHITTO, CHEFUNCTE RIVER, BOGUE FALIA, TICKFAW RIVER AND TRIBUTARIES, AMITE RIVER AND BAYOU MANCHAC, LOUISIANA.

(A) BOGUE CHITTO.

For history of this work, project, and results accomplished, see current summary, page 366, also Annual Reports of the Chief of Engineers for 1891, page 1800; 1892, page 1466; 1897, page 1703; 1899, page 1729; 1900, page 2222; and 1903, page 1300.

No work was done during the fiscal year ending June 30, 1905, available funds being insufficient. Such expenditures as were made during the year were for necessary travel expenses in connection with inspection of completed bridges.

The part of the stream which is navigable will require the removal of sunken logs from time to time, unless something be done to prevent the floating of loose logs, which are constantly sinking and obstructing the river.

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Money statement.

July 1, 1904, balance unexpended	$209.29
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	12.40
July 1, 1905, balance unexpended	196.89
Amount (estimated) required for completion of existing project	30,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	3,000.00

ABSTRACT OF APPROPRIATIONS.

By act of Congress—	
Approved September 19, 1890	$5,000
Approved July 13, 1892	5,000
Of August 18, 1894	5,000
Passed June 3, 1896	5,000
Approved March 3, 1899	5,000
Approved June 13, 1902 (allotted)	3,000
Total	28,000

COMMERCIAL STATISTICS FROM JANUARY 1, 1904, TO DECEMBER 31, 1904.

[No boats ply regularly on this river. All timber is rafted.]

Shipments by water.

Articles.	Tons.	Value.
Logs	48,750	$120,000
Lumber	975	9,100
Total	49,725	129,100

(B) CHEFUNCTE RIVER AND BOGUE FALIA.

For history of this work, projects, and results accomplished, see current summary, page 367, and Annual Reports of the Chief of Engineers for 1873, page 634; 1880, page 1182; 1884, page 1270; 1889, page 1530; 1893, page 1808; 1895, page 1742; 1899, page 1834, and 1903, page 1301.

No work was done during the past fiscal year, there being no funds available until nearly the end of the year.

The project approved May 10, 1905, provides for removing such snags, logs, and overhanging trees as interfere with navigation between the mouth of the Chefuncte and Covington on the Bogue Falia.

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Money statement.

May 5, 1905, amount allotted from appropriation of March 3, 1905, for "Improving Chefuncte River, Bogue Falia, Tickfaw River and tributaries, also Amite River and Bayou Manchac, Louisiana"	$500.00
July 1, 1905, balance unexpended	500.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	2,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

ABSTRACT OF APPROPRIATIONS.

By act of Congress—		By act of Congress—	
Approved March 3, 1881	$1,500.00	Approved June 13, 1902 (maintenance)	$3,000.00
Passed August 2, 1882	1,500.00	Approved March 3, 1905 (maintenance) (allotted)	500.00
Approved August 5, 1886	2,500.00	Total	14,000.00
Approved September 19, 1890	1,000.00	February 24, 1903, amount transferred to allotment for "Improving Amite River and Bayou Manchac, Louisiana"	1,194.01
Approved July 13, 1892 (maintenance)	1,000.00	Total balance	12,805.99
Of August 18, 1894 (maintenance)	1,000.00		
Passed June 3, 1896 (maintenance)	1,000.00		
Approved March 3, 1899 (maintenance)	1,000.00		

COMMERCIAL STATISTICS FROM JANUARY 1, 1904, TO DECEMBER 31, 1904.

Vessels entering and departing.

Class.	Number.	Trips.	Net registered tonnage.
Steamers	10	718	315
Sailing vessels	24	609	722
Barges	27	517	2,065
Total	61	1,844	3,102

Shipments and receipts by water.

Articles.	Tons.	Value.
Lumber	26,907	$251,128
Logs	853	2,100
Sand, brick, and clay	158,043	121,804
Rosin, turpentine, and tar	1,178	73,600
Cotton and cotton seed	193	40,895
Wood fuel	295	1,083
Hides and skins	1	155
Live stock	197	17,400
Miscellaneous freight	1,432	59,016
Total	184,099	567,131

NOTE.—The above covers only that portion of the business done between the Chefuncte River and New Orleans. Statistics covering that portion of the business with Ship Island, Gulfport, and other adjacent points could not be obtained.

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(c) TICKFAW RIVER AND TRIBUTARIES, LOUISIANA.

For history of this work, projects, and results accomplished, see current summary, page 368, and Annual Reports of the Chief of Engineers for 1880, page 1184; 1892, page 1484; 1893, page 1811; 1897, page 1753; 1899, page 1835, and 1903, page 1303.

The project approved May 10, 1905, provides for removing obstructions from the mouth of Tickfaw River and up this stream and the Natalbany as far as available funds will permit.

After advertisement by circular letter and public notice the proposal of J. H. Gardner Construction Company to furnish a dredge, with the necessary crew and experienced labor, for removing the obstructions for $44 per day of eight hours actual work was accepted. Operations were commenced June 24, 1905, and substantial progress was made by the end of the month.

Money statement.

July 1, 1904, balance unexpended	$79.44
May 5, 1905, amount allotted from appropriation of March 3, 1905, for "Improving Chefuncte River, Bogue Falia, Tickfaw River and tributaries, also Amite River and Bayou Manchac, Louisiana"	1,000.00
	1,079.44
June 30, 1905, amount expended during fiscal year for maintenance of improvement	35.82
July 1, 1905, balance unexpended	1,043.62
July 1, 1905, outstanding liabilities	325.88
July 1, 1905, balance available	717.74
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	2,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

ABSTRACT OF APPROPRIATIONS.

By act of Congress:	
Approved March 3, 1881	$2,000
Passed August 2, 1882	2,000
Approved August 5, 1886	2,000
Of August 11, 1888	1,000
Approved September 19, 1890	1,000
Approved July 13, 1892 (maintenance)	1,000
Of August 18, 1894 (maintenance)	1,000
Passed June 3, 1896 (maintenance)	1,000
Approved March 3, 1889 (maintenance)	1,000
Approved June 13, 1902 (maintenance) (allotted)	1,000
Approved March 3, 1905 (maintenance) (allotted)	1,000
Total	14,000

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COMMERCIAL STATISTICS FROM JANUARY 1, 1904, TO DECEMBER 31, 1904.

Vessels entering and departing.

Class.	Number.	Trips.	Net registered tonnage.
Steamers	6	238	192
Sailing vessels	19	159	479
Barges	3	3	192
Total	28	400	863

Shipments and receipts by water.

Articles.	Tons.	Value.
Lumber	25,860	$241,356
Logs	56,638	129,418
Staves	267	2,136
Bricks	125	413
Wood, fuel	1,798	6,293
Cotton	48	9,350
Hides, wool, and moss	1	300
Miscellaneous freight	1,537	44,700
Live stock	33	7,000
Total	86,302	440,966

NOTE.—The above only covers that portion of the business done between Tickfaw River and New Orleans. Statistics covering the business between this river and Ship Island, Gulfport, and other adjacent points could not be obtained.

(D) AMITE RIVER AND BAYOU MANCHAC, LOUISIANA.

For history of this work, projects and results accomplished, see current summary, page 369, and Annual Reports of the Chief of Engineers for 1880, page 1157; 1883, page 1105; 1884, page 1263; 1889, page 1529; 1891, page 1821; 1892, page 1486; 1893, page 1813; 1899, page 1837; and 1903, page 1305.

No work was done during the past fiscal year, the available balance not being sufficient for effective work until nearly the end of the year.

The project approved May 10, 1905, provides for redredging and removing obstructions at mouth of Bayou Manchac and redredging channel over bar at mouth of Amite River. Specifications have been prepared, the work advertised, and bids are to be opened July 12, 1905.

Money statement.

July 1, 1904, balance unexpended	$135.62
May 5, 1905, amount allotted from appropriation of March 3, 1905, for "improving Chefuncte River, Bogue Falia, Tickfaw River and tributaries, also Amite River and Bayou Manchac, Louisiana"	5,000.00
July 1, 1905, balance unexpended	5,135.62
Amount that can be profitably expended during fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	5,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

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ABSTRACT OF APPROPRIATIONS.

By act of Congress:		By act of Congress:	
Approved June 14, 1880..	$8,000.00	Approved June 13, 1902 (maintenance) (allotted)	$2,500.00
Approved March 3, 1881..	5,000.00	Approved March 3, 1905 (maintenance) (allotted)	5,000.00
Approved August 5, 1886.	2,000.00		41,300.00
Of August 11, 1888	5,000.00	February 24, 1903, amount transferred from allotment for "improving Chefuncte River and Bogue Falia, Louisiana"	1,194.01
Approved September 19, 1890	3,800.00		
Approved July 13, 1892 ($1,500 for maintenance)	2,500.00	Total	42,494.01
Of August 18, 1894 (maintenance)	2,500.00		
Passed June 3, 1895 (maintenance)	2,500.00		
Approved March 3, 1899 (maintenance)	2,500.00		

COMMERCIAL STATISTICS FROM JANUARY 1, 1904, TO DECEMBER 31, 1904.

Vessels entering and departing.

Class.	Number.	Trips.	Net registered tonnage.
Steamers	7	552	317
Sailing vessels	27	385	559
Barges	2	2	142
Total	36	939	1,018

Shipments and receipts by water.

Articles.	Tons.	Value.
Lumber	11,750	$195,825
Logs	66,225	159,123
Shingles and laths	22,387	20,882
Staves and headings	10,965	87,757
Cotton and cotton seed	2,774	355,419
Hides, furs, wool, and moss	9	1,221
Wood, fuel	4,481	15,684
Poultry and eggs	32	7,692
Miscellaneous freight	2,228	216,987
Total	120,851	1,060,490

NOTE.—The above only covers that portion of the business between the Amite River and New Orleans. Statistics covering the portion done between this stream and Ship Island, Gulfport, and adjacent points could not be obtained.

T 3.

IMPROVEMENT OF CHANNEL, BAY, AND PASSES OF BAYOU VERMILION AND MERMENTAU RIVER AND TRIBUTARIES, LOUISIANA.

(A) CHANNEL, BAY, AND PASSES OF BAYOU VERMILION.

For history of this work, projects, and results accomplished, see current summary, page 370, and Annual Reports of the Chief of Engineers for 1880, pages 1157–1165; 1883, page 1107; 1887, page

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1398; 1891, page 1856; 1893, page 1826; 1895, page 1766; 1899, page 1850; 1903, page 1306, and 1904, page 1908.

No work was done during the past fiscal year, the available balance not being sufficient for effective work until nearly the end of the year. Such expenditures as were made during the year were for contingencies and administration and collection of commercial statistics.

The project approved May 24, 1905, provides for removing obstructions from the channel from the mouth of the bayou to the railroad bridge, or as far as funds will permit.

Money statement.

July 1, 1904, balance unexpended	$36.80
May 23, 1905, amount allotted from appropriation of act of March 3, 1905, for "Improving channel, bay, and passes of Bayou Vermilion and Mermentau River and tributaries, Louisiana"	1,000.00
	1,036.80
June 30, 1905, amount expended during fiscal year for maintenance of improvement	60.90
July 1, 1905, balance unexpended	975.90
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to balance unexpended July 1, 1905	2,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

ABSTRACT OF APPROPRIATIONS.

By act of Congress:	
Approved June 14, 1880	$5,000
Approved March 3, 1881	4,900
Approved July 13, 1892	7,500
Passed August 18, 1894	5,000
Passed June 3, 1896	1,000
Approved March 3, 1899	2,500
Approved June 13, 1902 (allotted)	9,000
Approved March 3, 1905 (allotted)	1,000
Total	35,900
December 31, 1903, amount transferred from allotment for "Improving Mermentau River and tributaries, Louisiana"	200
Total	36,100

COMMERCIAL STATISTICS FROM JANUARY 1, 1904, TO DECEMBER 31, 1904.

Vessels entering and departing.

Class.	Number.	Trips.	Net registered tonnage.
Steamers	3	83	4,267
Sailing vessels	12	120	1,200
Barges	0	0	.....
Total	15	203	5,467

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Shipments and receipts by water.

Articles.	Tons.	Value.	Articles.	Tons.	Value.
SHIPMENTS.			RECEIPTS.		
Cotton and cotton seed	7,306	$354,036	Fuel oil	2,100	$14,250
Sugar cane	10,000	40,000	Lumber	200	2,400
Sugar and molasses	220	9,975	Merchandise	100	7,500
Rice	2,250	5,625	Machinery	100	10,000
Cattle	750	30,000			
Sand and shells	3,300	8,750			
Cord wood	3,000	10,500			
Total	26,826	458,886	Total	2,500	34,150

Grand total, 29,326 tons, valued at $493,036.

(B) MERMENTAU RIVER AND TRIBUTARIES, LOUISIANA.

For history of this work, projects, and results accomplished, see current summary, page 371, and Annual Reports of the Chief of Engineers for 1897, page 1767; 1900, page 2264 (maintenance), and 1903, page 1308.

No work was done during the past fiscal year, the available balance not being sufficient for effective work until nearly the end of the year. Such expenditures as were made during the year were for contingencies and administration and collection of commercial statistics.

The project approved May 24, 1905, provides for removing such obstructions as may develop after the present high stage in the river has passed, from the mouth of the Mermentau River to the head of navigation in the tributaries, or as far as funds will permit.

Money statement.

July 1, 1904, amount unexpended	$772.16
May 23, 1905, amount allotted from appropriation of act of March 3, 1905, for "Improving channel, bay, and passes of Bayou Vermilion and Mermentau River and tributaries, Louisiana"	2,000.00
	2,772.16
June 30, 1905, amount expended during fiscal year for maintenance of improvement	146.79
July 1, 1905, balance unexpended	2,625.37
July 1, 1905, outstanding liabilities	50.25
July 1, 1905, balance available	2,575.12
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	5,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

ABSTRACT OF APPROPRIATIONS.

By act of Congress:	
Approved July 13, 1892	$7,500.00
Passed August 18, 1894	5,000.00
Passed June 3, 1896	5,000.00
Approved March 3, 1899	6,115.25

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By act of Congress—Continued.	
Approved June 13, 1902	$2,500.00
Allotted March 3, 1905 (maintenance)	2,000.00
Total	28,115.25
December 31, 1903, amount transferred to allotment for "Improving channel, bay, and passes of Bayou Vermilion, Louisiana"	200.00
Total	27,915.25

COMMERCIAL STATISTICS FROM JANUARY 1, 1904, TO DECEMBER 31, 1904.

Vessels entering and departing.

Class.	Number.	Trips.	Net registered tonnage.
Steamers	5	120	4,200
Sailing vessels	7	115	2,340
Total	12	235	6,540

Shipments and receipts by water.

Articles.	Tons.	Value.	Articles.	Tons.	Value.
SHIPMENTS.			RECEIPTS.		
Rice	8,204	$232,792	Fuel oil	5,394	$28,186
Cotton and cotton seed	1,885	179,060	Logs	25,000	57,500
Cattle	100	6,000	Merchandise	1,000	75,000
Lumber	2,049	13,203	Machinery and iron	1,130	113,000
Hides and furs	20	2,000	Feed stuff	122	2,440
			Sand, lumber, and cement	130	450
			Miscellaneous	882	3,624
Total	12,258	433,055	Total	33,608	280,200

Grand total, 45,866 tons, valued at $713,255.

T 4.

IMPROVEMENT OF MOUTH AND PASSES OF CALCASIEU RIVER, LOUISIANA.

For history of this work, projects, and results accomplished see current summary, page 372, and Annual Reports of the Chief of Engineers, for 1871, page 558; 1872, page 61; 1881, pages 1302–1304; 1882, page 1387; 1886, page 1277; 1887, pages 1379–1403; 1895, page 1772; 1900, page 2266, and 1903, page 1309.

The contractor for repairs to and extension of east jetty began work September 15, 1904, and completed all work January 4, 1905.

The following is a summary of work done:

Tons of riprap stone in place	21,031.9
Square yards of brush mattress in place	5,333.34

52 granite capping stones raised and replaced on jetty.

This work resulted in repairing the 13 breaks in east jetty caused by the storm of 1900, and the extension of east jetty for a distance of 600 feet, the outer 200 feet of which being foundation work only.

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The act of March 3, 1905, appropriated $100,000 for continuing improvement, but before a satisfactory project could be prepared it seemed best to make a survey from the mouth of Calcasieu River to the outer pass, inasmuch as the channel through the inner bar or pass had shoaled to less than 4 feet and there was a channel of ample depth between the jetties. This survey was authorized May 20, 1905, and all preliminary arrangements have been completed for the survey party to take the field.

Money statement.

July 1, 1904, balance unexpended	$59,956.71
Amount appropriated by river and harbor act approved March 3, 1905	100,000.00
	159,956.71
June 30, 1905, amount expended during fiscal year, for works of improvement	59,678.28
July 1, 1905, balance unexpended	100,278.43
July 1, 1905, outstanding liabilities	70.40
July 1, 1905, balance available	100,208.03
Amount (estimated) required for completion of existing project	242,681.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	125,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

ABSTRACT OF APPROPRIATIONS.

By act of Congress—		By act of Congress—	
Approved June 10, 1872	$15,000	Passed August 18, 1894	$90,000
Approved March 3, 1881	15,000	Passed June 3, 1896	80,000
Passed August 2, 1882	10,000	Approved March 3, 1899	35,000
Approved July 5, 1884	6,500	Approved June 13, 1902	75,000
Of August 11, 1888	10,000	Approved March 3, 1905	100,000
Approved September 19, 1890	75,000	Total	611,500
Approved June 13, 1892	100,000		

ABSTRACT OF CONTRACTS IN FORCE DURING FISCAL YEAR ENDING JUNE 30, 1905.

Name and address of contractor: John Short, St. Louis, Mo.
Work: Repairs to and extension of east jetty at Calcasieu Pass, La.
Contract prices: Brush mattress in place, 95 cents per square yard; riprap stone in place, $2.50 per ton; granite blocks in place, $1.50 each.
Total approximate amount covered by contract: $55,000.
Dated: October 10, 1902.
Approved: November 15, 1902.
Date of expiration: November 19, 1903; time limit waived; completed January 4, 1905.

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COMMERCIAL STATISTICS FROM JANUARY 1, 1904, TO DECEMBER 31, 1904.

Vessels entering and departing.

Class.	Number.	Trips.	Net registered tonnage.
Steamers	7	445	14,855
Sailing vessels	15	120	4,674
Barges	14	150	9,500
Total	36	715	29,029

Shipments and receipts by water.

Articles.	Tons.	Value.	Articles.	Tons.	Value.
SHIPMENTS.			RECEIPTS.		
Cotton and cotton seed	2,063	$107,915	Logs	206,378	$481,544
Lumber	7,408	42,744	Merchandise	1,388	81,962
Cordwood	1,621	5,298	Fuel oil and coal	437	2,258
Rice	6,248	158,080	Machinery	385	38,500
Hides	7	700			
Fish and oysters	281	5,630			
Total	17,628	320,307	Total	208,588	604,264

Grand total, 226,216 tons, valued at $924,571.

T 5.

IMPROVEMENT OF JOHNSONS BAYOU, LOUISIANA.

For history of this work, project, and results accomplished, see current summary, page 374, and Annual Reports of the Chief of Engineers for 1900, page 2268, and 1903, page 1311.

No work was done for the improvement of this stream since December 26, 1899, and none being considered necessary, the unexpended balance was on June 30, 1904, carried to surplus fund.

Money statement.

July 1, 1903, balance unexpended	$238.65
June 30, 1904, balance carried to surplus fund	238.65

ABSTRACT OF APPROPRIATIONS.

By act of Congress:	
Approved March 3, 1899	$2,500

COMMERCIAL STATISTICS FROM JANUARY 1, 1904, TO DECEMBER 31, 1904.

Vessels entering and departing.

Class.	Number.	Trips.	Net registered tonnage.
Steamers	2	25	450
Sailing vessels	8	200	2,500
Total	10	225	2,950

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Shipments and receipts by water.

Articles.	Tons.	Value.	Articles.	Tons.	Value.
SHIPMENTS.			RECEIPTS.		
Cotton and cotton seed	483	$24,150	Merchandise	146	$10,950
Cattle	1,357	72,250	Lumber	2,000	10,000
Melons and garden truck	456	14,400	Machinery	55	13,000
Hides and furs	6	2,500	Coal and fuel oil	21	195
Miscellaneous	50	5,000			
Total	2,352	118,300	Total	2,222	34,145

Grand total, 4,574 tons, valued at $152,445.

T 6.

IMPROVEMENT OF THE MOUTHS OF THE SABINE AND NECHES RIVERS, TEXAS.

For history of this work, projects, and results accomplished, see current summary, page 375, and Annual Reports of the Chief of Engineers for 1900, page 2272; 1903, page 1314, and 1904, page 1914.

Under project approved May 6, 1904, bids were opened July 18, 1904, for dredging an 8-foot channel through Sabine Lake from the mouths of the Sabine and Neches rivers to Taylors Bayou. This project met with great opposition from those interested in the work, and the Chief of Engineers, on July 28, 1904, directed the rejection of all bids and the suspension of all work under the project.

By direction of the Secretary of War plans and specifications were prepared for dredging a channel 9 feet deep through the lake at or near its western shore as laid down in report printed in House Document No. 634, Fifty-eighth Congress, second session. (Annual Report for 1904, p. 1927.) These plans were submitted December 16, 1904, and approved January 14, 1905. The work was advertised and bids were opened February 18, 1905. No favorable bids were received and all were rejected.

The act of Congress approved March 3, 1905, contained the following:

"Improving mouths of Sabine and Neches rivers, Texas, in accordance with the report submitted in House Document Numbered Six hundred and thirty-four, Fifty-eighth Congress, second session, by connecting the same with Taylors Bayou, or a point in Sabine Lake near to the mouth of said bayou, by a channel at or near the west shore of Sabine Lake; the Secretary of War may enter into a contract or contracts for such materials and work as may be necessary to complete the said project, to be paid for as appropriations may from time to time be made by law, not to exceed in the aggregate four hundred and eleven thousand five hundred dollars, exclusive of the amounts heretofore appropriated: *Provided*, That the channel may, in the discretion of the Secretary of War, be constructed through the land near the lake for any part of said route: *Provided further*, That the right of way is furnished without expense to the United States."

Congress having adopted the project, a survey of the proposed route was made during April and May, 1905; the center line was marked with stakes and borings made every thousand feet along the center line. A map was prepared showing private property lines where the route of proposed canal passes and negotiations were undertaken to secure the required right of way.

At the end of the fiscal year these negotiations were still in progress.

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Money statement.

July 1, 1904, balance unexpended	$125,054.31
June 30, 1905, amount expended during fiscal year, for works of improvement	2,144.46
July 1, 1905, balance unexpended	122,909.85
July 1, 1905, outstanding liabilities	141.00
July 1, 1905, balance available	122,768.85
Amount (estimated) required for completion of existing project	411,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	200,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

ABSTRACT OF APPROPRIATIONS.

By act of Congress:	
Approved March 3, 1899	$10,000
Approved June 13, 1902	125,000
Total	135,000

COMMERCIAL STATISTICS FROM JANUARY 1, 1904, TO DECEMBER 31, 1904.

Vessels entering and departing.

[Neches River.]

Class.	Number.	Trips.	Net registered tonnage.
Steamers	12	290	4,000
Barges	9	287	42,000
Total	21	577	46,000

Shipments and receipts by water.

Articles.	Tons.	Value.	Articles.	Tons.	Value.
SHIPMENTS.			RECEIPTS.		
Lumber	250	$1,250	Logs	36,000	$84,000
Sand and shells	80,250	120,375	Produce	125	2,500
Fuel oil	40,462	216,762	Merchandise	100	7,500
Fresh water	2,881	8,575			
Rice	568	15,775			
Wood	880	3,090			
Total	125,291	365,817	Total	36,225	94,000

Grand total, 161,516 tons, valued at $459,817.

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T 8.

IMPROVEMENT OF SABINE RIVER, TEXAS.

For history of this work, projects, and results accomplished, see current summary, page 376, and Annual Reports of the Chief of Engineers for 1873, page 881; 1879, page 904; 1880, page 1195; 1886, page 1287; 1892, page 1510; 1893, page 1836; 1895, page 1779; 1897, page 1773; 1899, page 1857; 1900, page 2274, and 1901, page 1908.

No work has been done since July, 1900, and nothing further being proposed, the balance available was on June 30, 1905, covered into the surplus fund. The work will be dropped from the list of duties of the local officer.

Money statement.

July 1, 1904, balance unexpended	$161.67
June 30, 1905, balance carried to surplus fund	161.67

ABSTRACT OF APPROPRIATIONS.

By act of Congress:	
Approved June 10, 1872 (allotted)	$2,700
Approved June 18, 1878	10,000
Approved March 3, 1879	6,000
Approved June 14, 1880	5,000
Approved March 3, 1881	7,000
Passed August 2, 1882	4,000
Approved July 13, 1892	5,000
Passed August 18, 1894	5,000
Passed June 3, 1896	2,000
By act of Congress:	
Approved March 3, 1899 (maintenance)	$2,000
Amount allotted by sundry civil act of March 2, 1895, from appropriation of August 18, 1894, for "improving Sabine Pass, Texas"	4,000
Total	52,700

COMMERCIAL STATISTICS FROM JANUARY 1, 1904, TO DECEMBER 31, 1904.

Vessels entering and departing.

Class.	Number.	Trips.	Net registered tonnage.
Steamers	6	192	6,500
Sailing vessels	5	34	1,400
Barges	13	167	30,000
Total	24	393	37,900

Shipments and receipts by water.

Articles.	Tons.	Value.	Articles.	Tons.	Value.
SHIPMENTS.			RECEIPTS.		
Rice	718	$19,950	Logs	249,452	$570,000
Sand and shells	10,000	15,000	Fuel oil	1,400	5,000
Lumber	30,212	178,894	Merchandise	250	18,750
Staves	132	33,000			
Shingles	20	500			
Total	41,082	247,344	Total	251,102	593,750

Grand total, 292,184 tons, valued at $841,094.

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T 8.

IMPROVEMENT OF HARBOR AT SABINE PASS, TEXAS.

For history of this work, projects, and results accomplished, see current summary, page 377, and Annual Reports of the Chief of Engineers, for 1875, page 947; 1877, page 75; 1878, page 609; 1882, page 1436; 1883, page 1054; 1891, page 1831; 1896, page 1814; 1898, page 1482; 1899, page 1859; 1900, page 2276; 1901, page 1910; 1902, page 1349; 1903, page 1317, and 1904, page 1916.

Maintenance of jetty channel.—At the beginning of fiscal year the dredge *Sabine* was in dry dock at New Orleans for repairs. On July 13, the dredge was sent to South Pass, Mississippi River, under authority of the Chief of Engineers, for emergency work at that locality and she was engaged in this work until August 19.

The *Sabine* returned to Sabine Pass on August 21, 1904, and continued operations dredging in the channel between the jetties until May 12, 1905. On May 14 the dredge was sent to New Orleans for necessary repairs to her mud bins and machinery, and also to have an additional fuel oil tank installed, returning to Sabine Pass on June 22, 1905.

During the year the dredge removed and carried out to sea 422,175 cubic yards of material (estimated at 60 per cent of bin measurement), at a total cost of $28,634.46, including all repairs, or 6.78 cents per cubic yard.

On February 6, 1905, the working day of the dredge was increased from ten hours to eleven hours, and on April 5 to twelve hours.

The present available depth of channel at mean low tide is 23 feet. The material of the bottom is very soft mud, and vessels frequently pass out drawing over 25 feet.

It is not believed that a depth of 25 feet can be maintained throughout the jetty channel until the jetties are raised to the level of mean high water.

Repairs to east jetty.—Work under the contract approved November 15, 1902, with John Short, of St. Louis, Mo., was commenced August 5, 1903, and continued with slight interruptions, due to scarcity of rock, rough weather, accidents to contractor's plant, etc., until May 2, 1904, when work was entirely suspended, owing to financial troubles of the contractor.

Operations were resumed by the contractor July 30, 1904; 7,926.16 tons of riprap stone were placed in the jetties, and on September 12, 1904, the work under contract was completed. For additional details see appended report of Mr. F. F. Axtell, junior engineer.

Money statement.

July 1, 1904, balance unexpended	$56,386.61
Amount deposited by Captain McIndoe, July 14, 1904, account sale of engineer property	43.11
Amount deposited by Lieut. Col. Clinton B. Sears, September 13, 1904, from appropriation "Improving South Pass, Mississippi River," account repairs to dredge *Sabine*	882.21
Amout deposited by Lieut. Col. Clinton B. Sears, September 13, 1904, from appropriation "Improving South Pass, Mississippi River," account rental of dredge *Sabine*	1,330.00
Amount appropriated by act of March 3, 1905	150,000.00
	208,641.93

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June 30, 1905, amount expended during the year:		
For works of improvement	$236.77	
For maintenance of improvement	56,392.33	
		$56,629.10
July 1, 1905, balance unexpended		152,012.83
July 1, 1905, outstanding liabilities		2,840.53
July 1, 1905, balance available		149,172.35
July 1, 1905, amount covered by uncompleted contracts		90,000.00
Amount (estimated) required for completion of existing project		926,573.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to balance unexpended July 1, 1905:		
For works of improvement	$300,000.00	
For maintenance of improvement	30,000.00	
		330,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

ABSTRACT OF APPROPRIATIONS.

By act of Congress:	
From act approved August 30, 1852 (survey)	$5,000.00
Alloted from act approved June 10, 1873 (survey)	2,000.00
By act of Congress—	
Approved March 3, 1875	20,000.00
Approved August 14, 1876	38,000.00
Approved June 18, 1878 (allotted)	30,000.00
Approved March 3, 1879	25,000.00
Approved June 14, 1880	50,000.00
Approved March 3, 1881	150,000.00
Approved August 2, 1882	150,000.00
Approved July 5, 1884	200,000.00
Approved August 5, 1886	198,750.00
Of August 11, 1888	250,000.00
Approved September 19, 1890	300,000.00
Approved July 13, 1892	350,000.00
Of August 18, 1894	[a] 271,000.00
Of June 3, 1896	75,000.00
Approved June 4, 1897 (sundry civil)	480,000.00
Approved June 1, 1898 (sundry civil)	400,000.00
Approved March 3, 1899 (sundry civil)	264,000.00
Approved March 3, 1899 (river and harbor)	150,000.00
Approved June 6, 1900 (sundry civil)	36,000.00
Approved June 6, 1900 (emergencies in river and harbor works) (alloted)	10,000.00
Approved June 13, 1902 (river and harbor)	185,000.00
Approved March 3, 1905 (river and harbor)	150,000.00
Total	3,789,750.00
Reverted to Treasury from act of June 4, 1897	16,297.03
Net total	3,773,452.97
Amount received from other sources (see Money statement, p. 1472)	2,255.32
Total	3,775,708.29

[a] The total amount of this appropriation was originally $275,000, but of this sum $4,000 was allotted by sundry civil act of March 2, 1895, for dredging through a bar at the mouth of the Sabine River, Texas, and was expended on that improvement.

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ABSTRACT OF CONTRACTS IN FORCE DURING FISCAL YEAR.

Name and address of contractor: John Short, St. Louis, Mo.
Work: Repairs to and extension of east jetty.
Contract price: Riprap stone in place, $2.50 per ton.
Total approximate amount covered by contract: $95,000.
Dated: October 10, 1902.
Approved: November 15, 1902.
Date of expiration: November 19, 1903; time limit waived; completed September 12, 1904.

Name and address of contractor: Higgins Oil and Fuel Company, Beaumont, Tex.
Nature of contract: Furnishing about 3,500 barrels fuel oil for *Sabine*.
Contract price: 75 cents per barrel.
Total approximate amount covered by contract: $2,625.
Dated: March 30, 1904.
Approved: (Emergency).
Date of expiration: October 1, 1904.

Name and address of contractor: Higgins Oil and Fuel Company, Beaumont, Tex.
Nature of contract: Furnishing about 3,500 barrels fuel oil for *Sabine*.
Contract price: 75 cents per barrel.
Total approximate amount covered by contract: $2,625.
Dated: October 1, 1904.
Approved: (Emergency).
Date of expiration: April 2, 1905.

Name and address of contractor: Higgins Oil and Fuel Company, Beaumont, Tex.
Nature of contract: Furnishing about 3,500 barrels fuel oil for *Sabine*.
Contract price: 70 cents per barrel.
Total approximate amount covered by contract: $2,450.
Dated: March 31, 1905.
Approved: (Emergency).
Date of expiration: October 2, 1905.

Name and address of contractor: Charles Clarke & Co., Galveston, Tex.
Work: Repair of east jetty.
Contract price: Riprap stone, $2.29 per ton in place.
Total approximate amount covered: $90,000.
Dated: June 22, 1905.
Approved: July 6, 1905.
Date of expiration: July 10, 1906.

COMMERCIAL STATISTICS FROM JANUARY 1, 1904, TO DECEMBER 31, 1904.

Vessels entering and departing.

Class.	Number.	Trips.	Net registered tonnage.
Steamers	80	350	.....
Sailing vessels	25	65	.....
Barges	29	189	.....
Total	134	604	915,620

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Shipments and receipts by water.

Articles.	Tons.	Value.	Articles.	Tons.	Value.
SHIPMENTS.			RECEIPTS.		
Crude and refined oils	1,515,245	$6,493,904	Cement	510	$51,000
Lumber and square timber	160,820	900,592	Iron pipe	190	8,000
Staves	12,563	251,260	Fruit and coffee	75	7,500
Cotton	22,206	3,997,080	Creosote oil	2,268	45,360
Cotton seed, cakes, and meal	21,768	217,680			
Corn and wheat	27,296	591,412			
Rock	21,000	42,000			
Miscellaneous	8,430	126,450			
Total	1,789,328	12,620,378	Total	3,043	111,860

Grand totals, 1,792,371 tons, valued at $12,732,238.

REPORT OF MR. F. F. AXTELL, JUNIOR ENGINEER.

SABINE, TEX., *July 2, 1905.*

I have the honor to submit the following report of operations for improving harbor at Sabine Pass, Tex., for fiscal year ending June 30, 1905:

The work at Sabine Pass Harbor has consisted of dredging between the jetties by the U. S. dredge *Sabine*, the repair of the jetties under contract with John Short, of St. Louis, Mo., and miscellaneous and survey work.

Dredging between the jetties.—At the beginning of past fiscal year the U. S. dredge *Sabine* was laid up at New Orleans, La., in dry dock and undergoing repairs. July 15, 1904, the dredge began dredging at South Pass, mouth of Mississippi River, under orders from the Secretary of War, and continued dredging there for thirty-eight days. The dredge returned to Sabine Pass August 21, 1904, and immediately began dredging in jetty channel at Sabine Pass. May 14, 1905, the dredge left Sabine Pass for New Orleans, La., to undergo repairs to mud bins and machinery and have an additional fuel oil tank installed. Dredge returned to Sabine Pass June 22, 1905, and at the end of the fiscal year was engaged dredging in jetty channel.

Subtracting the time chargeable to dreding at South Pass, mouth of Mississippi River, there remains three thousand, five hundred and thirty-eight hours chargeable to dredging at Sabine Pass, Tex., the distribution of which time is as follows:

	Hours.	Minutes.
Effective working time	1,813	40
Lost time	1,724	20
Total	3,538	00
Distribution of working time:[a]		
Underway[a]	216	55
Pumping	682	15
Dumping[b]	837	15
Taking on fuel oil	60	05
Assisting vessels over bar	13	40
Sounding jetty channel	3	30
Total	1,813	40
Distribution of lost time:		
Rough sea and fog	366	35
Sundays and holidays	557	..
Washing out boilers	75	..
Ordinary repairs	151	..
Extraordinary repairs, in dry dock, and overhauling dredge and machinery at New Orleans, La.[c]	574	45
Total	1,724	20

[a] Includes time going to and from dredging ground each day.
[b] Includes time going to and from dumping ground.
[c] Includes time preparing for trip, going to New Orleans, La., returning to Sabine Pass, Tex., and getting ready for dredging.

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Amount of dredging:	
Number of loads of soft mud	2,165
Cubic yards, bin measurement	703,625
Solid material, estimated 60 per cent	422,175
Cost of dredging:	
Wages of crew	$9,472.47
Wages of subsistence department	538.33
Office expenses	1,466.88
Extra labor	62.00
Subsistence supplies	2,753.11
Fuel oil	4,302.52
Deck and engine room supplies	1,203.07
Ordinary repairs	463.34
Extraordinary repairs	8,144.76
Miscellaneous supplies	227.98
Total cost for dredging	28,634.46
Cost per cubic yard ..... cents	6.78

The jetty channel has been frequently inspected during the past year, and the dredge *Sabine* shifted from point to point in jetty channel in order to secure as uniform a channel as possible. The present available depth through the jetty channel at mean low Gulf level is 23 feet.

Repair of the jetties.—A contract was entered into October 10, 1902, with John Short, of St. Louis, Mo., for the repair of three breaks in east jetty at Sabine Pass, caused by the storm of September, 1900. At the close of last fiscal year work under this contract was temporarily suspended, owing to financial difficulties of contractor. The placing of rock under this contract was resumed July 30, 1904, and the contract completed September 12, 1904. Summary of work done under this contract is as follows:

Rock placed during fiscal year ending—	Tons.
June 30, 1904	28,143.68
June 30, 1905	7,926.16
Total rock placed under this contract	36,069.84

With the exception of the above repair work the condition of the Sabine Pass jetties is practically the same as it was a year ago.

Miscellaneous and survey work.—No complete survey of Sabine Pass was made during the past year.

Duplicate line of levels was run between existing bench marks and gauges along the Pass, which work and the cross sectioning of repaired portions of east jetty has been about all the survey work done here during the year.

An automatic tide gauge has been maintained here during the past two years, the records of which are very complete.

The floating plant at Sabine Pass, consisting of naphtha launch and yawl boats, has frequently during the past year been transferred to other work, receiving very severe usage. The work in connection with care of this plant has consequently been considerable.

Very respectfully, your obedient servant,

F. F. AXTELL,
Junior Engineer.

Capt. J. F. MCINDOE,
Corps of Engineers.

T 9.

REMOVING THE WATER HYACINTH, LOUISIANA AND TEXAS.

For history of this work, projects, and results accomplished, see current summary, page 380, and annual reports of the Chief of Engineers for 1900, page 2270; 1901, page 1906; 1903, page 1312; and 1904, page 1913.

At the beginning of the fiscal year the steamer *Ramos* was en route to Bayou Plaquemine, where spraying operations for the destruction

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of water hyacinths were commenced July 8, 1904. Operations were continued here and in Grand River, Bay Natchez, Bayou Goddell, Belle River, Bayou Long, Bayou Grosse Tete, and Bayou Choctaw until October 31, 1904.

During this period the spraying solution was furnished by the Harvesta Chemical Compounding Company. One hundred and twenty thousand gallons were used, which resulted in effectively clearing the streams named of all obstructing hyacinths.

When the weather did not permit spraying, the crew of the *Ramos* was engaged in constructing booms. One was placed across Bayou Plaquemine, one across Bayou Grosse Tete near its mouth, one across Bayou Grosse Tete at the head of navigation, near the town of Rosedale, and one across Bayou Choctaw. These booms, with the exception of the last named, are in charge of watchmen, whose duty it is to halt all passing boats and rafts and require them to clear away all hyacinths before passing through the boom. The boom at the mouth of Bayou Teche was operated until the high stage of water in the Atchafalaya River caused a strong current which carried all the hyacinths past the mouth of the Teche and rendered the operation of the boom unnecessary.

On November 8, 1904, the *Ramos* was placed out of commission at New Orleans. During the winter machinery and boilers were overhauled, a new cylinder timber was placed on the port side, cabin was altered to permit a pile driver to be placed on the bow, and a steam capstan was installed as a necessary equipment for the boat when working in shallow waters and as an accessory to the pile driver. In addition to these repairs and additions, the *Ramos* was docked at Morgan City, La., and calked in May, 1905.

Operations were resumed in Bayou Plaquemine April 8, 1905. Experiments by this office having demonstrated that a solution of white arsenic and washing soda, prepared in accordance with a formula furnished by the Agricultural Department, was effective in killing the water hyacinths, it was decided to discontinue the use of the Harvesta chemical compound. The new solution can be made for about one-third of a cent per gallon, whereas the price paid the Harvesta Chemical Compounding Company for their solution was 3 cents per gallon.

From April 8 to June 30, 1905, 72,442 gallons of the new spraying mixture were consumed. The total number of gallons of chemical mixture sprayed during the fiscal year was 192,442, and it is estimated each gallon destroyed approximately 12 square yards of hyacinths.

The present condition of the hyacinth-infested streams in the Plaquemine-Morgan City water route is very satisfactory and the clearing has been done at a much smaller cost than formerly.

Hyacinths are becoming troublesome in the Calcasieu River, Louisiana, and in the Sabine and Neches rivers in Texas. For operations in these streams it will be necessary to equip an additional boat with a spraying outfit.

The act of March 3, 1905, appropriated $40,000 for destruction of water hyacinths, and under projects approved April 22, 1905, and May 15, 1905, it is proposed to continue spraying operations and to equip the second steamboat. The hull and engines for the boat were purchased June 2, and other work necessary for her equipment is in progress.

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Money statement.

July 1, 1904, balance unexpended	$15,000.00
Amount deposited by Captain McIndoe, July 14, 1904, account sale of engineer property	3.86
Amount deposited by Captain McIndoe, December 28, 1904, account sale of engineer property	.30
Amount appropriated by river and harbor act approved March 3, 1905	40,000.00
	55,004.16
June 30, 1905, amount expended during fiscal year for works of improvement	14,990.69
July 1, 1905, balance unexpended	40,013.47
July 1, 1905, outstanding liabilities	4,382.77
July 1, 1905, balance available	35,630.70
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	10,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

ABSTRACT OF APPROPRIATIONS AND ALLOTMENTS.

By act of Congress:	
Approved March 3, 1899	$36,000.00
Allotted August 6, 1902	18,000.00
Allotted September 26, 1902	1,480.00
Allotted December 4, 1903	500.00
Allotted May 31, 1904, act of April 28, 1904	15,000.00
Approved March 3, 1905	40,000.00
Total	110,980.00
Received from other sources (see money statement)	4.16
Grand total	110,984.16

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APPENDIX U.

IMPROVEMENT OF CERTAIN RIVERS AND HARBORS IN TEXAS.

REPORT OF CAPT. EDGAR JADWIN, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1905, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Galveston Harbor, Texas.
2. Galveston channel, Texas.
3. Channel from Galveston Harbor to Texas City, Texas.
4. Galveston ship channel and Buffalo Bayou, Texas.
5. Operating and care of Morgans Canal, Texas.
6. Trinity River, Texas.
7. West Galveston Bay channel, Double Bayou, and the mouths of the adjacent streams, including Trinity River, Anahuac channel, and Cedar Bayou, Texas.
8. Operating and care of Galveston and Brazos Canal, Texas.
9. Brazos River, Texas, from Velasco to Old Washington.
10. Mouth of Brazos River, Texas.
11. Aransas Pass, Texas.
12. Harbor at Brazos Santiago, Texas.
13. Construction of sea wall, etc., along the front of the Fort Crockett Reservation, and from Thirty-ninth to Forty-fifth streets, Galveston, Texas.
14. Removing sunken vessels or craft obstructing or endangering navigation.

HARBOR LINES.

15. Matagorda Bay at Port Lavaca, Texas.

UNITED STATES ENGINEER OFFICE,
Galveston, Tex., July 22, 1905.

GENERAL: I have the honor to forward herewith annual reports for the works of river and harbor improvements in my charge for the fiscal year ending June 30, 1905.

Very respectfully, your obedient servant,

EDGAR JADWIN,
Captain, Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

U 1.

IMPROVEMENT OF GALVESTON HARBOR, TEXAS.

OPERATIONS DURING THE YEAR. JETTIES.

Operations were carried on during the year under a contract entered into April 6, 1903, and approved May 13, 1903, with J. M. O'Rourke & Co., of Galveston, Tex.

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South jetty.—The delivery of granite block on shore branch of jetty was continued and completed September 27, 1904. 10,168 tons were delivered at $2.59 per ton and placed at a cost of 53 cents per ton.

Repairs to this jetty are about one-third completed.

North jetty.—The delivery of granite riprap was continued and completed February 6, 1905. 59,024.54 tons were delivered and placed at $3.89 per ton.

Small riprap is required to fill voids in this jetty, otherwise the repairs are completed.

Further details of the work done are given in the report of Mr. E. M. Hartrick, assistant engineer, forwarded herewith.

DREDGING.

[By U. S. dredge *Gen. C. B. Comstock.*]

During the year the dredge was overhauled and repaired.

The dredge excavated, removed, and dumped from Galveston Harbor 1,091,640.5 cubic yards of material at a cost of 4.7 cents per cubic yard.

Further details of the operations of the dredge are given in the report of Mr. G. M. Prendergast, master, forwarded herewith.

[By U. S. dredge *Gen. H. M. Robert.*]

From July 3 to July 26 the dredge was engaged in dredging a channel for unloading riprap on the shore end of the north jetty. The dredge excavated 88,215 cubic yards of material at a cost of 4.21 cents per cubic yard.

A consolidated report of the operation of the dredge for the entire year will be found on pages 623 and 624 of this report.

RESURVEY OF GALVESTON BAY.

The work during the year has been the drafting of the chart, which is nearly completed.

SURVEYS.

Attention is invited to the map of the latest survey submitted herewith.

Project for the expenditure of funds appropriated and authorized to be contracted for by the act of March 3, 1905, was submitted and approved. Bids for jetty work were advertised for May 29, 1905, and opened June 28, 1905. The bid of Charles Clarke & Co., of Galveston, Tex., was recommended for acceptance.

The balance available on June 30, 1905, and additional appropriation recommended, it is proposed to apply to operating the U. S. dredge *Gen. C. B. Comstock* in maintaining, widening, and deepening the channel and repairing the south jetty.

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Money statement.

July 1, 1904, balance unexpended		$401,907.07
Amount appropriated by river and harbor act approved March 3, 1905		200,000.00
Proceeds of sales of condemned property		369.76
		602,276.83
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$392,295.83	
For maintenance of improvement	52,601.05	
		444,896.88
July 1, 1905, balance unexpended		157,379.95
July 1, 1905, outstanding liabilities		5,005.74
July 1, 1905, balance available		152,374.21
Amount (estimated) required for completion of existing project		[a] 745,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$745,000.00	
For maintenance of improvement	75,000.00	
		820,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

ABSTRACT OF APPROPRIATIONS.

July 11, 1870	$25,000	August 5, 1892	$450,000
March 3, 1871	20,000	March 3, 1893	1,000,000
June 10, 1872	31,000	August 18, 1894	600,000
June 23, 1874	60,000	January 25, 1895	200,000
March 3, 1875	150,000	March 2, 1895	1,160,000
August 14, 1876	142,000	February 26, 1896	300,000
June 7, 1878	75,000	June 3, 1896	50,000
June 18, 1878	50,000	June 11, 1896	840,000
March 3, 1879	100,000	June 4, 1897	500,000
June 14, 1880	175,000	March 3, 1899	50,000
March 3, 1881	250,000	June 13, 1902	350,000
March 4, 1882	100,000	March 3, 1903	300,000
August 2, 1882	300,000	April 28, 1904	100,000
August 5, 1886	300,000	March 3, 1905	200,000
August 11, 1888	500,000		
September 19, 1890	500,000	Total	9,478,000
March 3, 1891	600,000		

In addition to the above appropriations by Congress there has been collected from the steamship *Maritime*, $300; from Quartermaster's Department, United States Army, $719.83; from sales of condemned property, $464.23; transfer of tug *Anna*, $10,000, and refundment, by officer, $15.36; making a total of $9,489,499.42.

[a] Present indications are that a saving will be effected on the repairs to the jetties, but it is thought better not to modify estimates in this report.

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CONTRACTS IN FORCE.

Contractor: J. M. O'Rourke & Co., Galveston, Tex.
Character of work: Repairing jetties.
Rates:
For Galveston south jetty, large blocks, from 5 to 7 tons each, f. o. b. cars United States track Ninth street and Avenue A or eastward thereof, or Fort Point, Galveston, Tex., $2.59 per ton.
For Galveston north jetty, large riprap in pieces from 10 to 12 tons each, properly placed in the work, $3.89 per ton.
Date of approval: May 13, 1903.
Date of beginning work: August 16, 1903.
Date of expiration: Time limits waived. Contracts completed, south jetty, September, 1904; north jetty, February, 1905.

COMMERCIAL STATISTICS.

All the commerce of Galveston channel, Texas City channel, and Galveston ship channel and Buffalo Bayou, which come in from the Gulf or pass out to the Gulf, whether coastwise or foreign, pass through the jetty channel.

REPORT OF MR. E. M. HARTRICK, ASSISTANT ENGINEER.

GALVESTON, TEX., *July 15, 1905.*

CAPTAIN: I have the honor to submit the following report of operations for improving the harbor at Galveston, Tex., during the fiscal year ending June 30, 1905:

OPERATIONS DURING THE YEAR.

South jetty.—The delivery of granite block on shore branch of south jetty was continued and completed September 27, 1904. The United States Government unloaded and placed the block, except where the placing would require the removal of trestle and track. In such case the blocks were piled up alongside to be placed as soon as the trestle and track were in less demand, after the delivery of material for Fort San Jacinto had been completed.

Statement of material and labor expended, with cost of same, in the repairs of south jetty, Galveston Harbor, during the year ending June 30, 1905.

	Tons.
Granite blocks received and unloaded this year	10,168.00
Previously reported	33,867.02
Total contract	44,035.02

At $2.59 per ton, $114,050.79.
The blocks were unloaded and placed between station 29 and station 143 + 63 this year, and for the whole contract between station 6 and station 143 + 63.

REPAIRS.

Repairs to trestle and track amounting to $5,495.45 were made over a distance of 7,015 linear feet, of which $1,265.75 were charged to south jetty, $2,121.18 to gun battery, and $2,108.52 to mortar battery, Fort San Jacinto.
Repairs to an amount of $93.07 were made to coal bin at Fort Point by placing fender piles in front of the wharf and constructing bitts for mooring dredge *Gen. C. B. Comstock.*
To protect small boats, flats, and pontoons of the Government, a breakwater has been constructed by bolting old I-beams to piling of wharf, at a cost of $192.39.
North jetty.—The delivery of granite riprap was continued between station 185 and the outer end at station 255 and from station 100 inshore to station 9. The contract was completed February 6, 1905.

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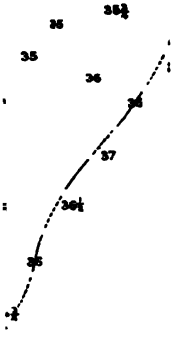

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As the contractor's floating plant could not unload and place large riprap inshore on account of shoal water, the Government dredge *Gen. H. M. Robert* was put to work on south side of north jetty, at station 9, on July 3, 1904. A channel 6,150 feet long was excavated to a depth of 9 feet and 80 feet wide between station 9 and station 15+150. Eighty-eight thousand two hundred and fifteen cubic yards of silt and sand were removed and deposited over the jetty on the north side. The dredge worked night and day and completed the channel July 26, 1904.

Statement of material used and cost of same in repairing north jetty, Galveston Harbor, during the year ending June 30, 1905, with total amount of contract.

	Tons.	Rate.	Value.
Granite riprap unloaded and placed this year	59,024.54	$3.89	$229,605.45
Previously reported	45,991.63	3.89	178,907.44
Total contract	105,016.17	.....	408,512.89

Very respectfully, your obedient servant,

E. M. HARTRICK,
Assistant Engineer.

Capt. EDGAR JADWIN,
Corps of Engineers.

DREDGING OPERATIONS IN GALVESTON HARBOR BY U. S. DREDGE GEN. C. B. COMSTOCK, G. M. PRENDERGAST, MASTER.

From July 1 to July 23 dredge was continuously employed on Galveston Harbor outer bar channel, weather permitting, and at other times on channel over inner bar.

From July 21 to August 1 the dredge was stripped of anchors, suction pipes, etc., in readiness to be hauled out on marine ways to repair broken hopper door in forward bin, port side. On August 1 dredge was hauled in position in marine ways slip and a trial to haul out dredge was made; but before dredge was half out of water it was found that eight links of chain had parted and it would be impossible to haul out dredge until new chain could be purchased. On August 5, after putting aboard anchors, suctions, etc., the dredge resumed work with one hopper door disabled. From August 5 to September 28 dredge was continuously employed on outer and inner bar, but was obliged to stop operations on September 29 until new circulating and air pump was installed in pump room. Only two days' time was lost in installing new pump and on October 1 dredge was again in commission.

From October 1 to December 14 dredge was continuously dredging on outer and inner bar channel. On December 14 the forward hopper door, forward hopper, port side, was broken, putting two doors in same hopper out of commission, and it became impossible to dump material with the two doors broken in same bin. From December 15 to February 22 dredge was undergoing extraordinary repairs, was hauled out, doors overhauled, new pumps installed, and a general overhauling to machinery. On February 23 dredge was again in commission and continuously employed until May 18, when dredge was again hauled out on ways to repair two broken doors in forward hopper on port side. From May 18 to 31 dredge was repairing doors, etc., and on June 1 was again in commission and continued so to end of fiscal year.

CREW AND HOURS.

From July 1 to June 30 dredge carried a double crew of 42 men, except at such times as dredge was undergoing repairs. The time accounted for from July 1 to September 30 was from sixteen to eighteen hours, and from October 1 to February 28 and from March 9 to June 30 the entire twenty-four hours of each day has been accounted for.

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Work done.

Location and character of material.	Amount dredged.		Cubic yard.		
	Number of loads.	Cubic yards.	Rate per minute.	Rate per hour.	Total time, fiscal year.
					Hrs. min.
Outer bar, sand, clay, and shell	928	512,713.2	8.49	509	1,006 06
Inner bar, sand and silt	1,071	578,927.3	8.31	499	1,160 42
Total	1,999	1,091,640.5	16.80	1,008	2,166 48

Cost per cubic yard—	Cents.
For fiscal year	4.7
Operating	3.4

Distribution of working time.

	Hrs.	min.
Anchor to cut	75	25
Pumping	2,166	48
Cut to dump	419	03
Dumping	123	00
Dump to cut	309	44
Dump to anchor	126	08
Turning	000	03
Total	3,220	11

Distribution of time.

	Hrs.	min.
Effective working time	3,220	11
Delays for bad weather	313	34
Delays for repairs	1,206	24
Delays for other causes	874	46
Sundays and holidays	1,026	00
Grand total time	6,640	55

Money expended.

Wages	$17,698.54
Subsistence	5,273.87
Fuel	8,124.84
Oils, waste, etc	985.74
Ordinary maintenance	5,478.26
Operating cost	37,561.25
Extraordinary repairs	14,102.51
Total expended	51,663.76

Cost of dredging.

Total cast of dredging for—	Cents.
Month of June	2.6
Fiscal year	4.7

Very respectfully, your obedient servant,

G. M. PRENDERGAST, *Master.*

Capt. EDGAR JADWIN,
Corps of Engineers.

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U 2.

IMPROVEMENT OF GALVESTON CHANNEL, TEXAS.

OPERATIONS DURING THE YEAR.

Under the contract of the Bowers Southern Dredging Company, of Galveston, Tex., for dredging, entered into on February 9, 1903, and approved March 2, 1903, 312,865 cubic yards of material were excavated from prescribed cross section and 31,112 cubic yards below prescribed cross section. This contract was completed during August, 1904.

At the close of the fiscal year the 550-foot channel from Red Beacon to Thirty-first street and the 200-foot channel between Thirty-first and Forty-fourth streets has shoaled to 29 feet, with a reduction in width of channel to about 400 and 180 feet, respectively, showing a filling of 807,000 cubic yards since channel was dredged.

The side slopes of the cut are flatter and the flats between the channel and dike have scoured away from one-half to 2 feet.

The pile and brush dike was reenforced with brush and excavated material between the Red Beacon and Twenty-third street and is at the close of the fiscal year in fair condition.

Further details of the work are given in the report of Mr. E. M. Hartrick, assistant engineer, forwarded herewith.

The U. S. dredge *Gen. H. M. Robert* excavated and deposited behind the pile and brush dike on Pelican Island and flats 565,138 cubic yards of material, at a cost of 4.68 cents per cubic yard.

A consolidated report of the operations of the dredge for the entire year will be found on pages 623 and 624 of this report.

The sum of $20,000 was allotted during the year from the appropriation for maintenance of river and harbor improvements, act of April 28, 1904, for maintaining the improvement.

Project for the expenditure of funds appropriated by act of March 3, 1905, was submitted and approved.

Bids for the dredge authorized by this act were advertised for May 1, 1905, and opened May 31, 1905, and contract entered into with the Bowers Southern Dredging Company, of Galveston, Tex., on June 23, 1905, and approved June 28, 1905.

The balance available on June 30, 1905, and additional appropriation recommended it is proposed to apply to dredging and maintenance of dike.

Money statement.

July 1, 1904, balance unexpended		$81,924.59
Amount appropriated by river and harbor act approved March 3, 1905.		175,000.00
Amount allotted from appropriation for maintenance of river and harbor improvements, act of April 28, 1904		20,000.00
		276,924.59
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$82,776.94	
For maintenance of improvement	14,075.44	
		96,852.38

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July 1, 1905, balance unexpended	$180,072.
July 1, 1905, outstanding liabilities	470.
July 1, 1905, balance available	179,601.
July 1, 1905, amount covered by uncompleted contracts	102,500
Amount (estimated) required for completion of existing project	1,110,000
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:	
For works of improvement	$125,000.00
For maintenance of improvement	50,000.00
	175,000

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

ABSTRACT OF APPROPRIATIONS.

June 13, 1902	$100,
March 3, 1903	200,
March 3, 1905	175,
Total	475,

In addition to the above appropriations by Congress there has been allotted fr appropriation for maintenance of river and harbor improvements, act of April 1904, $20,000, making a total of $495,000.

CONTRACTS IN FORCE.

Formal contract.

Contractor: Bowers Southern Dredging Company, Galveston, Tex.
Character of work: Dredging.
Rate: 8.3 cents per cubic yard.
Date of approval: March 2, 1903.
Date of beginning work: June 14, 1903.
Date of expiration: December 31, 1904. Completed August, 1904.
Contractors: Bowers Southern Dredging Company, Galveston, Tex.
Character of work: Constructing suction dredge.
Rate: $102,500.
Date of approval: June 28, 1905.
Date of beginning work: July 28, 1905.
Date of expiration: September 1, 1905.

COMMERCIAL STATISTICS OF GALVESTON, TEX., FOR THE FISCAL YEAR ENDING JUNE 1905, FURNISHED BY COLLECTOR OF CUSTOMS, PORT OF GALVESTON, TEX.

Tonnage of vessels and revenue collected.

	Steam vessels.	Sailing vessels.	Tot
Entered	755	28	
Cleared	773	28	

Duties on imports collected	$338,
All moneys collected at custom-house	372,

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Amount and value of freight entered and cleared.

Articles.	Tons.	Approximate value.
Cotton (2,685,234 bales)	709,461	$126,808,286
Cotton products	282,818	8,123,681
Ore	8,922	267,241
Wool	29,616	10,138,427
Grain	159,187	2,790,060
Sugar	133,819	13,390,355
Coal	33,198	198,402
General merchandise	[a] 560,252	[a] 355,360,170
Flour	2,654	117,839
Lumber and manufactures of wood	128,604	1,458,302
Cement	7,309	73,217
Petroleum	9,272	93,476
Manufactures of iron and steel	41,182	1,450,911
Cattle and other animals	31,867	1,583,460
Total	2,138,161	521,848,847

[a] See appended letters in regard to this item.

The statistics furnished with the annual report for Galveston Harbor in recent years have been in error in also including the commerce passing through the subports embraced in the customs district of Galveston, Tex. Those given above are for the port of Galveston alone.

LETTERS OF LIEUT. COL. CLINTON B. SEARS, CORPS OF ENGINEERS, DIVISION ENGINEER, GULF DIVISION.

CORPS OF ENGINEERS, U. S. ARMY,
GULF DIVISION,
New Orleans, La., September 14, 1905.

GENERAL: Referring to that portion of Captain Jadwin's annual report, which gives the commercial statistics for Galveston, Tex., I would respectfully invite attention to the inclosed copy of correspondence with Captain Jadwin as to the accuracy of the valuation of the item of "General merchandise."

I am still of the opinion that this valuation is entirely too high and will result in giving Galveston an entirely unwarranted position on the list of harbors arranged according to values of commerce.

Very respectfully,

CLINTON B. SEARS,
Lieut. Col., Corps of Engineers, U. S. A.,
Division Engineer, Gulf Division.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

CORPS OF ENGINEERS, U. S. ARMY,
GULF DIVISION,
New Orleans, La., August 28, 1905.

CAPTAIN: I have the honor to acknowledge the receipt of your letter of the 23d instant, transmitting copy of commercial statistics for Galveston, Tex., for fiscal year ending June 30, 1905, for substitution for sheet filed with annual report.

I would invite your attention to the item, "General merchandise, 560,252 tons, valued at $355,360,170." This is over $634 per ton,

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which is, in my opinion, nearly four times greater than any lot of general merchandise will average up in this or any other country.

In preparing the statistics for Duluth-Superior Harbor, which were as full, complete, and accurate as to tonnage as have ever been compiled, owing to the very favorable conditions obtaining, which enabled us to gather in everything going in or out, we put general merchandise at $165 a ton, and $200 would be an outside figure.

I would recommend a reconsideration of this item.

Your other unit prices seem to be all right.

Very respectfully,

CLINTON B. SEARS,
Lieut. Col., Corps of Engineers,
Division Engineer.

Capt. EDGAR JADWIN,
Corps of Engineers, U. S. A.,
Galveston, Tex.

LETTER OF CAPT. EDGAR JADWIN, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Galveston, Tex., September 11, 1905.

COLONEL: Replying to your letter of August 28, 1905, in regard to item of "General merchandise" in commercial statistics for Galveston, Tex., for fiscal year ending June 30, 1905.

On receipt of your letter, I took the matter up with Mr. F. L. Lee, collector of customs, whose office furnished the statistics, and I have the honor to inclose herewith copy of his reply in the matter.

Very respectfully, your obedient servant,

EDGAR JADWIN,
Captain, Corps of Engineers, U. S. A.

Lieut. Col. CLINTON B. SEARS,
Corps of Engineers,
Division Engineer, Gulf Division.

LETTER OF MR. F. L. LEE, COLLECTOR OF CUSTOMS.

UNITED STATES CUSTOMS SERVICE,
Galveston, Tex., September 1, 1905.

SIR: Referring to your letter of the 31st ultimo, concerning the commercial statistics at this port for the fiscal year ended June 30, 1905, and replying thereto, you are respectfully advised that under the present system governing entrance and clearance of vessels in coastwise trade it is almost impossible to make accurate estimates of the value of general merchandise.

This office makes a monthly statement of all articles entered and cleared coastwise in the district of Galveston, which itemizes the merchandise as far as possible. It is true that part of these cargoes can be itemized and is carried as so and so many packages of general merchandise, but the balance of the merchandise is given by articles, and practically correct estimates may be formed as to their value. The valuation accepted by this office was ascertained upon careful investigation of the various railway and steamship companies entering at this port, and is considered correct and not overestimated.

Respectfully,

F. L. LEE,
Collector.

CAPT. EDGAR JADWIN,
Corps of Engineers, Galveston, Tex.

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REPORT OF MR. E. M. HARTRICK, ASSISTANT ENGINEER.

GALVESTON, TEX., *July 15, 1905.*

CAPTAIN: I have the honor to submit the following report of operations for improving Galveston channel, Texas, during the fiscal year ending June 30, 1905:

DREDGING.

The contractor's plant consisted of the *Geo. Sealy*. The material was taken from a cut 200 feet wide made along the wharf front from Thirty-sixth to Forty-fourth streets, and the spoil deposited north of the dike on Pelican flats constructed by the Government. The Southern Pacific Railway Company's bulkhead was also utilized to retain the spoil when excavating abreast of their wharves. On August 7, 1904, the *Geo. Sealy* was removed from the work, and contract closed.

Amount of material dredged during the year.

	Cubic yards.
Geo. Sealy	343,977

Statement of material excavated and removed, with cost of same, from Galveston channel during the year ending June 30, 1905.

	Quantity.	Rate per cubic yard.	Cost.
	Cu. yds.	*Cents.*	
Prescribed cross section	312,865	8.3	$25,967.79
Below prescribed cross section	31,112	4.15	1,291.16
Total	343,977	.....	27,258.95

Previously excavated (1,993,153 cubic yards)	$156,978.74
For the year ending June 30, 1905 (343,977 cubic yards)	27,258.95
Total contract (2,337,130 cubic yards)	184,237.69

Work on Pelican Spit dike was continued with Government dredge *Gen. H. M. Robert* during August, September, and October, 1904, then the dredge was put to work reinforcing the dike on Pelican flats, between Red Beacon and Twenty-third street, where there were several low places through which water passed at ordinary tide. The pile dike was refilled with brush, and levees constructed from 200 to 300 feet north of pile and brush dike. The space thus bounded was filled with material taken from Galveston channel to a height of about 4 feet.

Very respectfully, your obedient servant,

E. M. HARTRICK,
Assistant Engineer.

Capt. EDGAR JADWIN,
Corps of Engineers.

U 3.

IMPROVEMENT OF CHANNEL FROM GALVESTON HARBOR TO TEXAS CITY, TEXAS.

The dredging of this channel was done under contract entered into with the Drake & Stratton Company, of New York, N. Y., for $250,000.

The terms of this contract, as amended by supplemental articles of agreement in accordance with the river and harbor act approved June 13, 1902, provide that payment of 5 per centum of the whole contract price shall be made from time to time for each 1,000 linear feet along the length of the channel, whenever it shall satisfactorily appear to the Secretary of War that depth of 25 feet and width of 100 feet at

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the bottom are obtained, until the sum of $200,000 has been paid, after which no payment shall be made until the whole channel has been completed to the required width and depth, at which time the balance of the contract price shall be paid.

Prior to the close of the last fiscal year all of the channel had been brought at different times to the contract depth, but not simultaneously, and the $200,000 had been paid.

At the beginning of the fiscal year the channel had a width of 100 feet and depth of 25 feet from station 0 + 6 at Texas City wharves to station 8 + 45, a distance of 7,850 feet. Ahead of the dredge some sections had shoaled to 16 feet, deepening to 25 feet at the entrance to the channel from the east.

OPERATIONS DURING THE YEAR.

Contractors continued dredging the channel preparatory to sweeping for final acceptance and completed the channel to prescribed cross section, 100 feet wide at bottom and 25 feet deep, from Texas City wharves to 25 feet of water in Galveston Harbor, a distance of 34,000 feet.

Survey of the channel was completed and work accepted on May 19, 1905.

Further details of the work are given in report of Mr. E. M. Hartrick, forwarded herewith.

Amount expended on this improvement to June 30, 1905, $250,000 from appropriations by Congress and $4,585.01 from the amount deposited by contractors for expenses of superintendence, inspection, etc.

Additional appropriation recommended is proposed to apply to maintaining the channel.

Money statement.

July 1, 1904, balance unexpended	$50,000.00
June 30, 1905, amount expended during fiscal year, for works of improvement	50,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	50,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

ABSTRACT OF APPROPRIATIONS.

By act of March 3, 1899	$250,000

CONTRACTS IN FORCE.

Contractor: The Drake & Stratton Company, New York, N. Y.
Character of work: Dredging.
Rates: $250,000 (5 per cent of contract price to be paid for each 1,000 feet of completed channel until $200,000 has been paid, after which no payments shall be made until whole channel is completed).
Date of approval: January 22, 1900.
Date of beginning work: June 30, 1900.
Date of expiration: September 12, 1904. Time limit waived. Contract completed May 19, 1905.

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COMMERCIAL STATISTICS.

The following commercial statistics were furnished by Mr. K. R. Guthrie, manager, Texas City Transport Company:

[New port, first steamer arrived September 20, 1904.]

Vessels using the channel.

Steam vessels		70
Average length	feet	270
Average draft	do	18
Total tonnage		106,386
Barges		25
Average length	feet	60
Average draft	do	4
Total tonnage		5,000

Amount and value of freight transported, including exports and imports.

Articles.	Tons.	Approximate value.
Bran	235	$47,000
Cotton (6,596 bales)	1,649	329,800
Corn	998	22,954
Coal	109	600
Coffee	132	26,400
Cotton waste	47	4,700
Cocoanuts	19	380
Hay	543	4,344
Hides	29	580
Lumber	10,193	101,930
Live stock	509	50,900
Mahogany logs	2,660	133,000
Machinery	59	1,180
Merchandise	12	1,200
Oil	35	100
Onions	4	80
Packing-house products	368	58,880
Potatoes	29	1,160
Poultry	26	4,160
Rice	64	9,660
Sisal fiber	18,418	2,946,880
Total	36,138	3,745,888

REPORT OF MR. E. M. HARTRICK, ASSISTANT ENGINEER.

GALVESTON, TEX., *July 15, 1905.*

CAPTAIN: I have the honor to submit the following report of operations for the improvement of the channel from Galveston Harbor to Texas City, Tex., during the fiscal year ending June 30, 1905:

CONDITION OF THE WORK.

At the end of the fiscal year the channel was complete to prescribed cross section, 100 feet wide at bottom and 25 feet deep from Texas City wharves to 25 feet of water in Galveston Harbor, a distance of 34,000 feet. About 4,156,717 cubic yards of material have been removed from the prescribed cross section of this channel, including redredging.

OPERATIONS DURING THE YEAR.

No original work was undertaken except to clean up the channel preparatory to sweeping. After several attempts to clean up with one dredge two extra dredges were put to work, which gave the necessary depth and width for sweeping. The work was accepted on May 19, 1905, after the swinging, mooring, and trestle piles, obstructions to navigation, had been removed from Half Moon channel. Cross sections were taken every 100 feet apart and plotted.

Very respectfully, your obedient servant,

E. M. HARTRICK,
Assistant Engineer.

Capt. EDGAR JADWIN,
Corps of Engineers.

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U 4.

IMPROVEMENT OF GALVESTON SHIP CHANNEL AND BUFFALO BAYOU, TEXAS.

OPERATIONS DURING THE YEAR.

Active operations were carried on during the fiscal year under contract entered into February 9, 1903, and approved March 2, 1903, with the Bowers Southern Dredging Company, of Galveston, Tex.

DIVISION 1 (BAY DIVISION), FIRST SUBDIVISION, LOWER BAY.

Work was continued to December 14, 1904. 1,566,042.24 cubic yards were dredged by dredge *No. 6* between station 33+2 and station 66+5 and spoil deposited from 2,000 to 3,000 feet on the west of cut.

Statement of material excavated and cost of same during the year ending June 30, 1905.

	Quantity.	Rate per cubic yard.	Total cost.
	Cubic yards.	*Cents.*	
Prescribed cross section	1,374,207.61	8.8	$120,930.27
Below prescribed cross section	191,834.63	4.4	8,440.72
Total	1,566,042.24	.....	129,370.99

Since the completion of the 150-foot channel it has silted up to an amount of about 1,133,000 cubic yards.

DIVISION 1 (BAY DIVISION), SECOND SUBDIVISION, UPPER BAY.

No work was done during the year.

Since the completion of the 150-foot channel it has silted up to an amount of about 1,434,000 cubic yards.

For operating and care of Morgan Canal, which is a part of this division, see page 1499 of this report.

DIVISION 2 (RIVER DIVISION).

A total of 1,001,531 cubic yards of material were excavated as per prescribed cross section, 18½ feet deep and 100 feet wide, and 149,190 cubic yards below prescribed cross section.

The U. S. snag boat *Gen. S. M. Mansfield* operated between Irish Bend and Harrisburg, a distance of over 8 miles, removing 703 snags at a cost of $1,063.89.

Rights of way were received and recorded from time to time and a special map to facilitate checking up the land donated to the United States for excavating and dumping purposes. Surveys for several proposed cut-offs and easements were made.

Since the completion of the 100-foot channel it has silted up to an amount of about 585,000 cubic yards.

DIVISION 3 (RIVER DIVISION).

The U. S. snag boat *Gen. S. M. Mansfield* operated between Harrisburg and head of Long reach, removing 857 snags at a cost of $1,032.17.

A hydrographical and topographical survey from Harrisburg to the head of Long reach has been made, cross sections plotted, and esti-

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mates for a channel 100 feet wide and 18½ and 25 feet deep at mean low water have been made.

A right of way survey has also been made, map plotted, and the larger part of the necessary land obtained.

Project for the expenditure of funds appropriated and authorized to be contracted for by the act of March 3, 1905, was submitted and approved.

Further details of the work done are given in the report of Mr. F. C. Stanton, junior engineer, forwarded herewith.

The balance available on June 30, 1905, and additional appropriation recommended, is proposed to apply to maintaining and deepening the channel and extending it to the head of Long reach.

Money statement.

July 1, 1904, balance unexpended		$505,320.36
Amount appropriated by river and harbor act approved March 3, 1905.		200,000.00
Proceeds of sales of condemned property		.10
		705,320.46
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$323,172.69	
For maintenance of improvement	20,055.20	
		343,227.89
July 1, 1905, balance unexpended		362,092.57
July 1, 1905, outstanding liabilities		28,304.96
July 1, 1905, balance available		333,787.61
July 1, 1905, amount covered by uncompleted contracts		45,194.77
Amount (estimated) required for completion of existing project		3,350,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$350,000.00	
For maintenance of improvement	150,000.00	
		500,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

ABSTRACT OF APPROPRIATIONS.

Galveston ship channel and Buffalo Bayou.

March 3, 1889	$300,000
June 13, 1902	300,000
March 3, 1903	500,000
April 28, 1904	200,000
March 3, 1905	200,000
Total	1,500,000

Ship channel in Galveston Bay, Texas.

June 10, 1872	$10,000.00	August 2, 1882	$94,500.00
June 23, 1874	10,000.00	August 11, 1888	100,000.00
March 3, 1875	35,200.00	September 19, 1890	132,316.85
August 14, 1876	72,000.00	July 13, 1893	40,000.00
June 18, 1878	75,000.00	August 18, 1894	50,000.00
March 3, 1879	80,000.00	June 3, 1896	50,000.00
June 14, 1880	50,000.00		
March 3, 1881	50,000.00	Total	849,016.85

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Buffalo Bayou, Texas.

March 3, 1881	$25,000	July 13, 1892	$25,000
August 2, 1882	50,000	August 18, 1894	15,000
July 2, 1884	25,000	June 3, 1896	20,000
August 5, 1886	18,750		
August 11, 1888	25,000	Total	228,750
September 19, 1890	25,000		

In addition to the above appropriations by Congress 14 cents have been received from the sale of condemned property.

CONTRACTS IN FORCE.

Contractor: Bowers Southern Dredging Company, Galveston, Tex.
Character of work: Dredging.
Rates:
Division 1, 8.8 cents per cubic yard.
Division 2, 14 cents per cubic yard.
Date of approval: March 2, 1903.
Date of beginning work: June 14, 1903.
Date of expiration: December 31, 1904. Work completed on division 1. Time limit waived for division 2.

COMMERCIAL STATISTICS.

The only commercial statistics that could be obtained for the fiscal year was the amount carried by the Direct Navigation Company, as follows:

[Vessels using the bay and river divisions, 23 (5 steam vessels and 18 barges); average length, 162 feet; average draft, 8 feet 6 inches.]

Articles.	Quantity.	Approximate value.
	Tons.	
Cotton (381,686 bales)	102,101	$17,175,870.00
Coal	613	6,130.00
Bank sand	2,747	1,248.50
Roofing slate	51	1,020.00
Linseed oil	13	1,675.00
Burlap bags	15	1,200.00
Gas piping	375	18,750.00
Cotton bagging	180	13,350.00
Cotton (up from Galveston)	40	6,750.00
Total	106,135	17,225,993.50

REPORT OF MR. F. C. STANTON, JUNIOR ENGINEER.

GALVESTON, TEX., *July 15, 1905.*

CAPTAIN: In have the honor to submit the following report for improving Divisions 2 and 3, Galveston ship channel and Buffalo Bayou, Texas, during the fiscal year ending June 30, 1905:

DIVISION 2.

At the end of the fiscal year 2,007,691 cubic yards of material had been excavated and removed, completing a channel of prescribed width 100 feet, and over 18½ feet deep between station 0, the north end of Morgan Canal, and station 84+300, a distance of about 16 miles, also from station 89+908 (mile 17) to station C5+480 (mile 21⅛), also from station A7+5 (mile 22⅛) to station A (mile 23½), a total distance of 113,862 feet.

In addition to this there has been excavated at Irish Bend 335,000 cubic yards of material, forming a channel over 100 feet wide and 12 feet deep from station 85+500 (mile 16.2) to station 86+800 (mile 16.4), and from station 87+570 (mile 16.6) to station 88+975 (mile 16.9), a distance of 2,705 feet.

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OPERATIONS DURING THE YEAR.

At the beginning of the year dredges *Atlantic* and *No. 7* were at work. Dredge *Geo. Sealy* arrived on August 10, 1904, and was removed on October 22, 1904. The *Atlantic* and *No. 7* finished during November, 1904. On April 11, 1905, dredge *No. 6* started work, followed by dredge *No. 7* on April 15, 1905.

Amount of material excavated by each dredge during the year.

	Cubic yards.
Dredge *Sealy* (20 inches)	184,800
Dredge *No. 6* (20 inches)	202,000
Dredge *No. 7* (18 inches)	256,816
Dredge *Atlantic* (26 inches)	507,105

Statement of material excavated and removed, with cost of same, during the year ending June 30, 1905.

	Quantity.	Rate per cubic yard.	Total cost.
	Cubic yards.	*Cents.*	
Prescribed cross section	1,001,531	14	$140,214.34
Below prescribed cross section	149,190	7	10,443.30
Total	1,150,721		150,657.64

Very respectfully, your obedient servant,

F. C. STANTON,
Junior Engineer.

Capt. EDGAR JADWIN,
Corps of Engineers.

REPORT OF THE BOARD OF ENGINEERS FOR RIVERS AND HARBORS.

WASHINGTON, D. C., *December 15, 1904.*

GENERAL: 1. By first indorsement, Office of the Chief of Engineers, U. S. Army, dated August 11, 1904, there was referred to the Board of Engineers for Rivers and Harbors a resolution adopted by the Committee on Rivers and Harbors of the House of Representatives, as follows:

Resolved, That the chairman be requested and directed to transmit to the Chief of Engineers a request that the Board of Engineering Officers, created under section 3 of the river and harbor act approved June 13, 1902, be requested to examine the Galveston ship channel and Buffalo Bayou improvement, for which appropriation was made in the said act of June 13, 1902, with a view to determining the desirability of terminating such improvement at some point below Houston; also with a view to ascertain whether the channel can be judiciously improved by cut-offs, or the plan as outlined in the original report recommending the improvement upon which the said appropriation was made can be advantageously modified in other respects, and the said Board is requested to take into consideration present and prospective conditions.

There was also referred to the Board by ninth indorsement, August 25, 1904, in connection with the above, a report by the district officer in which he recommends that cut-offs be authorized at Irish and Clinton bends, and that a working radius of 2,500 feet be adopted for the easement of other bends.

2. The Board has carefully considered all data at hand. On November 11, 1904, a committee of the Board, in company with the district officer and a representative of the Houston deep-water committee,

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made an inspection of Buffalo Bayou, and on the 12th held a public hearing at Houston, at which all persons interested were given an opportunity to be heard.

3. The existing project for the improvement of Buffalo Bayou, adopted by the river and harbor act of March 3, 1899, and based on a report of a Board of Engineers dated November 3, 1897, provides for a channel depth of 25 feet from the jetties at Galveston to Houston, with a width of 150 feet from the jetties to the upper end of Morgans Cut canal, and 100 feet from this point to the city of Houston, Tex. The total length of the channel from the jetties to Houston is about 58 miles. For the purposes of estimate the reach was divided into three divisions: Division 1, 25 miles, extending from the jetties to the north end of Morgans canal; division 2, 24 miles, from Morgans canal to Harrisburg; and division 3, 9 miles, from Harrisburg to Houston. The estimated cost of the improvement was $4,000,000. Under this project $1,300,000 has been appropriated, and in accordance with the law is being expended in securing a uniform depth in divisions 1 and 2. It is expected to secure with available funds a channel of the prescribed width with a depth of 18½ feet from the jetties to Harrisburg.

4. In the report of November 3, 1897, upon which the project was based, it was stated that division 3 was narrow and tortuous, with high banks, and would require the removal of at least one bend by cut-off and the straightening and widening of others. In referring to division 2 it was stated that the bayou becomes wider and deeper, with more gentle curves, which afford no serious obstruction to navigation. It appears that the map upon which this report was based was on a very small scale and only approximately correct, and that more recent surveys have developed the fact that at least two bends, Irish Bend and Clinton Bend in division 2, the former having a minimum radius of 660 feet and the latter a radius of 980 feet, are too sharp for convenient navigation of the larger vessels which may be expected to use this channel. The district officer recommends that a cut-off be made at each of these bends, having a radius of approximately 2,500 feet, and that this radius be adopted in easing off the bends of less radii than 2,500 feet. It has been demonstrated by actual experience in the navigation of these bends that vessels of 220 to 246 feet length were obliged to reduce their speed to 2 miles per hour, and even then at times ran into the bank. It is clear to the Board that modern vessels of 300 to 350 feet length, which are expected to use this waterway, would have great difficulty in rounding the bends as they exist. The Board believes that all bends on this water route should be reduced to a radius of curvature as large as possible consistent with a reasonable expenditure. It seems, from the investigation made by the district officer, that this limit of curvature might be fixed at 2,500 feet. This radius can be attained below Harrisburg by making a cut-off at Irish and at Clinton bends, and by a reasonable amount of easement of several points. The Board recommends that these cut-offs and the adoption of a working radius of 2,500 feet for bends be authorized.

5. It will be seen from the map, and it was apparent to the Board in its examination of division 3, that if the improvement is carried as far as the present business center of the city of Houston there will be required at least five expensive cut-offs, and that, in order to attain a

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bottom width of 100 feet, which is called for by the project, and which the Board believes to be the least that should be adopted, the excavation will have to extend into one or both banks for a considerable distance, as the stream has not sufficient natural width to permit of a channel of the prescribed dimensions without encroaching upon its banks. In the upper part of division 2, where the average width of the water surface at mean low tide is 142 feet, dredging to a depth of 18½ feet has caused the banks to seriously slough in at several places. The Board believes that with an increase in depth to 25 feet this sloughing in of the banks will also increase.

6. In division 3, from Harrisburg to the head of the Long reach, a distance of about 2 miles, the average width is 141 feet. From the head of Long reach to Turkey Bend the average width is 112 feet, and from Turkey Bend to Houston the average width is 91 feet. The banks in the vicinity of Long reach are of moderate height, but they increase materially toward Houston. From the experience in dredging in division 2, it is apparent that a channel of even 18 feet in depth can not be secured above the head of Long reach without encroaching seriously upon the adjacent banks, which would involve enormous expenditures. In the report of 1897 it was proposed to remove the point which is just below the San Antonio and Aransas Pass bridge, which lies about 2¼ miles below White Oak Bayou, to afford a harbor of a width of 500 feet, which was required by the act of Congress. It was also proposed to widen the channel at the mouth of White Oak Bayou in Houston so as to afford a turning place for vessels which may be required to go above the proposed harbor. It would appear, therefore, that the head of the deep-water channel was contemplated at a point 2¼ miles below White Oak Bayou, and that for the convenience of local traffic the width at White Oak Bayou was to be enlarged.

7. At the public hearing it developed that the people of Houston desire that the upper terminal of the improvement be located at a point as near the business center of Houston as possible. The Board recognizes that it would be more convenient for local interests if the head of the work were located near the present business section, but it believes that the same benefits will accrue to the country at large and to the commercial interests involved if the head of the improvement is located at any point above Harrisburg. The physical conditions limit the head of the improvement to the upper end of Long reach; above this the work can not be extended without making several expensive cut-offs and carrying the dredging into the banks for the entire distance. Such extension could only be made at a cost entirely incommensurate with the benefits to result therefrom. The distance from White Oak Bayou to the head of Long reach is about 6 miles by water and 4 miles by land. If the terminal is located at the latter point, local interests will probably adjust themselves to this condition in a very short time.

8. To carry the improvement to the head of Long reach there will have to be made a cut-off through the point opposite Harrisburg and a turning basin at or near the upper end of the reach. In view of the present tendency toward increased length of vessels, and because all reasonable harbor facilities demanded by these vessels should be provided in order to secure the full value of the improvement, the Board believes that a turning basin with an available width of 600 feet, instead

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of 500 feet as contemplated by Congress in the act ordering the survey, should be constructed.

9. As a result of its investigations, the Board is of the opinion that the present project for a 25-foot ship channel can advantageously be modified in the following particulars:

First. Terminate the improvement at a point near the head of Long reach.

Second. Provide cut-offs at Irish Bend, Clinton Bend, and at a point opposite Harrisburg, with at least a radius of 2,500 feet.

Third. Ease all other bends at the same minimum radius.

Fourth. Provide a turning basin near the head of Long reach, with a width of 600 feet instead of 500 feet.

10. In connection with the above modifications, the Board desires to call attention to the rapid fill that has taken place in the excavated channel in division 1. During the period March, 1903, to November, 1904, this division was dredged to the projected width of 150 feet and to a depth of somewhat over 18½ feet. Recent soundings develop the fact that a fill has taken place at the rate of 103,910 cubic yards per mile per year, or a total of 2,164,920 cubic yards for the 20.8 miles of division 1, over which the measurements were taken. Under a former contract for redredging in this division, the price paid was 8.8 cents per cubic yard. To restore this channel to its former depth will, at the same price, cost $190,512.

11. From data furnished by the district officer, it is estimated that the redredging required to maintain the entire channel will at present contract prices cost $378,400 annually—2,000,000 cubic yards in division 1 at 8.8 cents, and 1,200,000 cubic yards in divisions 2 and 3 at 14 cents, with 10 per cent additional for contingencies of engineering and inspection. With a Government dredge it is believed that this cost will be materially reduced, and for this reason the Board includes the cost of such a dredge in its estimates. It is also probable that the cost may be reduced by the construction of a dike on the west side of the channel below Morgans Cut. It is believed, however, that the construction of this second dike should be undertaken in a tentative manner, and that at present its length should be limited to about 26,000 feet, ending at an angle in the existing dike.

12. The estimated cost of completing the project as modified above is as follows:

For completing channel to head of Long reach, including turning basin 600 feet in diameter, 25 feet deep, side slopes 1 on 2, division 1 (bay); 1 on 3 in divisions 2 and 3 (river); least radius, 2,500 feet, 150 feet on bottom in division 1 (bay); 100 feet on bottom in divisions 2 and 3 (river)	$3,170,000
26,000 feet of dike revetment	40,000
1 hydraulic dredge	150,000
Engineering and contingencies, about 10 per cent	340,000
Total	3,700,000
Amount available December 1, 1904	150,000
Balance required	3,550,000

This estimate is based upon the assumption that the right of way for the channel and dumping grounds for the deposit of dredged material will be provided by the local interests without cost to the United States, as has been done in connection with the work heretofore performed.

13. The foregoing is believed to fully answer the questions submitted by the River and Harbor Committee of the House of Representatives.

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The original estimate of cost is exceeded by the present estimate for a shorter channel and for certain modifications of the project deemed essential, but the present estimates are predicated upon more reliable data.

Respectfully submitted.

D. W. LOCKWOOD,
Lieut. Col., Corps of Engineers.
R. L. HOXIE,
Lieut. Col., Corps of Engineers.
S. W. ROESSLER,
Major, Corps of Engineers.
EDW. BURR,
Major, Corps of Engineers.
CHARLES W. KUTZ,
Captain, Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

U 5.

OPERATING AND CARE OF MORGAN CANAL, TEXAS.

A watchman was stationed at the canal during the year to enforce the regulations governing the navigation of the canal.

Condition of canal.—At the beginning of the fiscal year the sheet-piling bulkhead on the west side of the canal was in fairly good condition. On the east side the woodwork above mean low tide was rotting and gradually breaking away; that below the water line was in fairly good condition. Six hundred and twenty feet of bulkhead and 450 feet of barbed-wire fence had been destroyed by fire.

During the fiscal year the bulkhead has further deteriorated. The 620 feet of bulkhead destroyed by fire has been replaced and the barbed-wire fence partially repaired by the Bowers Southern Dredging Company.

The depth of water in the canal is 18½ feet.

For improvement of waterway of which this canal is a part, see page 1492 of this report.

The amount expended during the fiscal year was as follows:

Watchmen	$360.00
Blanks for office use	.90
Total	360.90

Money statement.

July 1, 1904, balance unexpended	$30.90
Amount allotted July 8, 1904	360.00
Amount allotted June 23, 1905	360.00
	750.90
June 30, 1905, amount expended during fiscal year	360.90
July 1, 1905, balance unexpended	390.00
July 1, 1905, outstanding liabilities	30.00
July 1, 1905, balance available	360.00

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ABSTRACT OF ALLOTMENTS FOR MORGAN'S CANAL.

December 2, 1896	$240	July 18, 1902	$360
July 16, 1897	360	June 24, 1903	360
July 1, 1898	360	July 8, 1904	360
July 1, 1899	360	June 23, 1905	360
July 14, 1900	360		
June 11, 1901	5,000	Total	8,120

COMMERCIAL STATISTICS.

Number and tonnage of vessels passing up and down through Morgan's Canal during the fiscal year ending June 30, 1905, as reported by the watchman at the canal.

	Number.	Registered tonnage.
Vessels engaged in carrying freight	1,749	96,797
Vessels in the employ of the United States or its contractors	237	4,316
Total	1,986	103,113

U 6.

IMPROVEMENT OF TRINITY RIVER, TEXAS.

SECTION ONE.

Logs were removed from the Malloy Drift at mile 483½. Contour maps and borings were made at lock sites Nos. 1 and 6, and borings made at lock site No. 4 and Parsons Slough. Test piles were driven at lock site No. 6 to better determine the nature of the foundation. Owing to a decided dip in the clay strata, necessitating piling under part of the improvement and a possibility of a cut-off immediately above, a second survey was made for Lock No. 6 about one-half a mile above. Test piles were driven and the results were more favorable, and the final location of Lock No. 6 was made at the site of second survey.

Plans were completed for Lock and Dam No. 1, mile 499½, and partially completed for Lock and Dam No. 6, mile 470½, and dam at Parsons Slough, mile 490½. Project was submitted and approved, and specifications for locks and dams were completed and forwarded.

Land for site for Lock and Dam No. 1 was deeded to the United States.

MOUTH TO SECTION ONE.

Operations were continued on this portion of the river to during March, 1905, when work was suspended owing to the act of March 3, 1905, diverting the funds for this section of the river to section one.

Snags were cut off between miles 296.5 to 319, and 439.5 to 445, a total distance of 28 miles. Snags and overhanging trees were removed entirely between miles 319 to 372.5, 380 to 384, 0 to 31½, and 33½ to 41, a total distance of 96.5 miles; and partly removed between miles 372.5 to 380, 384 to 421, and 31½ to 33½, a total distance of 46.5 miles.

The stern-wheel snag boat *Gen. S. M. Mansfield* was completed and removed obstructions from mile 0 to 41.

Total distance from which obstructions were removed was 171 miles,

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and 1,818 obstructions were removed. In addition to the above, 3,100 feet of drift was removed between miles 319 and 372.5.

Plans and specifications were completed for lock and dam near Liberty, Tex., at mile 30.

Work on the Red bank drifts was completed.

Money statement.

July 1, 1904, balance unexpended	$298,947.25
Deposited by citizens of Dallas, Tex	66,000.00
Proceeds of sales of condemned property	1.50
	364,948.75
June 30, 1905, amount expended during fiscal year, for works of improvement	50,335.91
July 1, 1905, balance unexpended	314,612.84
July 1, 1905, outstanding liabilities	316.73
	314,296.11
Amount (estimated) required for completion of existing project	161,287.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:	
For works of improvement [a]	$161,287.00
For maintenance of improvement [b]	35,000.00
	196,287.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

ABSTRACT OF APPROPRIATIONS.

March 3, 1899	$7,000
June 13, 1902	125,000
March 3, 1903	250,000
Total	382,000

In addition to the above appropriations by Congress there has been received $31.27 from sales of condemned property and $66,000 from the citizens of Dallas, Tex., making a total of $448,031.27.

[a] This is amount authorized by river and harbor act of March 3, 1905, which, it is believed, Congress is in honor bound to appropriate, in view of wording of said act and advancement of $66,000 by citizens of Dallas, unless this money is returned to the donors. Its expenditure will, in my opinion, not be profitable in advance of work on the river from mouth to section one. The river is 512 miles long to Dallas. At present reliable navigation is had regularly for 20 miles from the mouth only. Three-foot navigation can not be relied on sufficiently regularly to justify the maintenance of a boat to Liberty, 40 miles from the mouth. It is therefore visionary to expect any adequate returns from money spent more than 450 miles from the mouth before the lower part of the river is further improved. The river can also be improved considerably more economically by working upstream. The principal advantage, however, to the community at large would be that in this case lower freight rates would be carried upward with each lock, while the time of completion of the entire improvement, if Congress wishes to improve the entire river, would not be postponed. If improved downward from Dallas it would prove of little more benefit than one extra road until the entire improvement had been advanced far enough to secure a reduction in through rates. Three hundred thousand dollars can be spent profitably in work beginning at lower end of river.

[b] This item is principally for continuous maintenance of snag boat. If maintained in operation it will be able to do much additional snagging and bank clearing, besides maintaining river already cleared.

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COMMERCIAL STATISTICS.

For commercial statistics for the fiscal year see report on the mouth of the river under heading for improving West Galveston Bay channel, Double Bayou, and the mouth of adjacent streams, Texas, including Trinity River, Anahuac channel, and Cedar Bayou, Texas.

The only navigation above Liberty, known to this office, is the rafting of logs in time of floods over the lower 180 miles of the river.

U 7.

IMPROVEMENT OF WEST GALVESTON BAY CHANNEL, DOUBLE BAYOU, AND THE MOUTHS OF THE ADJACENT STREAMS, INCLUDING TRINITY RIVER, ANAHUAC CHANNEL, AND CEDAR BAYOU, TEXAS.

OPERATIONS DURING THE YEAR.

At Double Bayou.—The U. S. dredge *Gen. H. M. Robert* excavated a channel across the bar with a ruling depth of 5 feet, and 85 feet wide, and excavated 80,480 cubic yards of material at a cost of 2.79 cents per cubic yard.

The material was composed of hard clay and shell with a little silt, and was deposited on the west side of cut, about 200 feet from axis.

The amount expended during the year was $2,464.65.

At Anahuac channel.—The U. S. dredge *Gen. H. M. Robert* dredged from 6 feet of water in Trinity Bay, and excavated a channel 12,238 feet long, 80 feet wide, and 7 feet deep between station O and station 12+238, and excavated 119,401 cubic yards of material at a cost of 2.94 cents per cubic yard.

The U. S. snag boat *Gen. S. M. Mansfield* removed from the entrance to Browns Pass, off Anahuac channel, 212 large snags, opening it to navigation, and also removed part of an old bulkhead which had been placed across the channel some years ago by a lumber company.

Amount expended during the fiscal year was $567.75.

At Galveston and Brazos Canal.—3,236 feet of canal were cleared of grass, logs, and about 8,000 cubic yards of silt and sticky clay to a depth of 3 feet and 45 feet wide between mile 33 and 32¾, by the *Pigmy*. On August 26, 1904, operations were suspended. A break in the bulkhead constructed across the canal occurred at mile 33½.

Amount expended during the fiscal year was $5,893.35.

For operating and care of this canal see page 1506 of this report.

In addition to the amounts expended at the above improvements during the fiscal year, $2.30 was expended in examination of Clear Creek, Texas, and $103.50 in repairs to launch and $214.74 for installing cutter on dredge *Gen. H. M. Robert.*

DREDGE GEN. H. M. ROBERT.

Details of the operation of the dredge for the entire year are given in the report of Mr. J. A. Masculine, master, forwarded herewith.

Project for expenditure of the funds appropriated by act of March 3, 1905, was submitted and approved.

With the balance available June 30, 1905, it is expected that Anahuac channel will be completed, further snagging done at the mouth of the Trinity, and West Bay channel and Galveston and Brazos Canal brought to a depth of at least 3 feet and beaconed where most urgently

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needed. The additional appropriation recommended it is proposed to apply to dredging, snagging, and minor repairs to jetties, etc., in accordance with project.

Money statement.

July 1, 1904, balance unexpended		$7,798.83
Amount appropriated by river and harbor act approved March 3, 1905		50,000.00
Proceeds of sales of condemned property		11.79
		57,810.62
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$11,141.00	
For maintenance of improvement	3,081.50	
		14,222.50
July 1, 1905, balance unexpended		43,588.12
July 1, 1905, outstanding liabilities		3,760.23
July 1, 1905, balance available		39,827.89
Amount (estimated) required for completion of existing project		86,800.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$86,800.00	
For maintenance of improvement	35,000.00	
		121,800.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

ABSTRACT OF APPROPRIATIONS.

March 3, 1899	$65,000
June 15, 1902	50,000
March 3, 1905	50,000
Total	165,000

In addition to the above appropriations by Congress there has been received from sales of condemned property $26.97, making a total of $165,026.97.

COMMERCIAL STATISTICS.

During the year about 25,000 sacks of rice, worth $2 a sack, were taken out of Double Bayou and Anahuac channel; 16,000,000 feet sawed lumber, 3,500 piles, and 4,000 hewn ties out of the mouth of the Trinity River; about 1,150,000 brick out of Cedar Bayou; cord word, charcoal, river sand, shell for road purposes, and miscellaneous farm products from various works interested in the improvement.

Four steam tugs, a fleet of barges, and probably upward of 150 sail boats utilize the channels, generally bringing their products to Galveston and Houston, and returning with merchandise. About 1,000 tons general merchandise were taken in through the mouth of Trinity to Wallisville. Within the year many of the schooners have added auxiliary gasoline engines to enable them to run independently of the wind.

OPERATIONS OF U. S. DREDGE GEN. H. M. ROBERT, J. A. MASCULINE, MASTER.

CAPTAIN: I have the honor to submit the following report of operations of the U. S. dredge *Gen. H. M. Robert* during the fiscal year ending June 30, 1905:

Total number of cubic yards excavated	1,031,162.00
Number of cubic yards dredged per hour	423.82
Number of cubic yards dredged per minute	7.06

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Running expenses.

	Amount expended.	Cost per yard.
Wages	$18,866.29	$0.0183
Subsistence	4,445.42	.0043
Fuel	4,451.72	.0043
Oils, waste, etc	735.50	.0007
Miscellaneous supplies	1,983.12	.0019
Ordinary maintenance	3,962.10	.0038
Contingent expenses	647.03	.0007
Services, launch Helen	2,188.56	.0021
Overhauling Pigmy and Travis	125.93	.0001
Dike, labor, trestle, etc	2,132.90	.0021
Addition to plant	1,630.21	.0016
Fort Point, miscellaneous charges	314.14	.0003
Extraordinary repairs	1,444.82	.0014
Total cost	42,927.74	.0416

Cost at each improvement.

Improvement.	Yards.	Cost per yard.	Amount expended.
Galveston Harbor, north jetty	88,215	$0.0421	$3,715.86
Inland waterway (Cedar Bayou)	119,851	.0399	4,784.06
Inland waterway (mouth of Trinity River)	58,077	.0382	2,218.78
Inland waterway (Double Bayou)	80,480	.0279	2,241.42
Inland waterway (Anahuac channel)	119,401	.0294	3,517.89
Galveston channel	565,138	.0468	26,449.73
Total	1,031,162	.0416	42,927.74

Distribution of time.

	h.	m.
Washing boilers	179	05
Effective working time	2,433	45
Delays for bad weather	87	10
Delays for repairs	393	35
Delays for other causes	431	55
Idle on account of Sundays and holidays	784	00
Handling ponton and pipe line	219	25
Handling swinging wires and anchors	174	05
Changing location of dredge	193	00
Total time to be accounted for	4,896	00

Very respectfully, your obedient servant,

J. A. MASCULINE,
Master of Dredge.

Capt. EDGAR JADWIN,
Corps of Engineers.

(A) MOUTH OF TRINITY RIVER.

OPERATIONS DURING THE YEAR.

The U. S. dredge *Gen. H. M. Robert* dredged at Middle Pass from 6 feet of water in Trinity Bay and continued to 6 feet of water in Trinity River, a distance of 5,700 feet and 80 feet wide, and excavated 58,077 cubic yards of material at a cost of 3.82 cents per cubic yard.

The material excavated was composed of silt, sand, and shell, and was deposited on west side of cut 200 feet from axis until the west

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jetty was reached, when the pipe line was shortened and the spoil deposited over the jetty. The plank jetty is steadily deteriorating from age and effect of drift and log jams.

The U. S. snag boat *Gen. S. M. Mansfield* removed log jam from Middle Pass; 1,477 logs and small snags were removed. Middle Pass is now in constant use by towboats and auxiliary schooners.

Amount expended during the fiscal year was $3,081.50 for maintenance.

ABSTRACT OF APPROPRIATIONS.

August 30, 1852	$3,000	September 19, 1890	$10,000
June 18, 1878	10,000	July 13, 1892	10,000
March 3, 1879	2,500	August 18, 1894	5,000
June 14, 1880	4,000	June 3, 1896	5,000
March 3, 1881	10,000		
August 2, 1882	8,000	Total	80,000
August 11, 1888	12,500		

(B) CEDAR BAYOU.

The U. S. dredge *Gen. H. M. Robert* excavated a channel 8 feet deep, 80 feet wide, for a distance of 1,300 feet between the jetties and a channel of same depth and width for a distance of 7,390 feet across Cloppers bar to 8 feet of water to San Jacinto Bay, and excavated 119,851 cubic yards of material at a cost of 3.99 cents per cubic yard.

A total of 307.67 tons of riprap were deposited on the jetties at a total cost of $874.63, leaving same in comparatively good condition, with lowest places and gaps filled.

Amount expended on this improvement during fiscal year was $5,000 from act of June 13, 1902, and in addition $1,826.16 from act of March 3, 1905, making a total of $6,826.16.

Money statement.

July 1, 1904, balance unexpended	$5,000.00
June 30, 1905, amount expended during fiscal year, for works of improvement	5,000.00

ABSTRACT OF APPROPRIATIONS.

September 19, 1890	$18,150
July 13, 1892	14,000
June 13, 1902	5,000
Total	37,150

(C) CHANNEL IN WEST GALVESTON BAY.

OPERATIONS DURING THE YEAR.

During the year the U. S. snag boat *Gen. S. M. Mansfield* was prepared for dredging. Six piles and 21 iron pipes were removed from the channel and 7 iron tripods and 3 signal beacons were erected.

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Amount expended on this improvement during fiscal year was $1,920.60 from act of June 3, 1896, and in addition $68.55 from act of March 3, 1905, making a total of $1,989.15.

Money statement.

July 1, 1904, balance unexpended	$4,698.51
June 30, 1905, amount expended during fiscal year, for works of improvement	1,920.60
July 1, 1905, balance unexpended	2,777.91
July 1, 1905, outstanding liabilities	2,172.22
July 1, 1905, balance available	605.69

ABSTRACT OF APPROPRIATIONS.

July 13, 1892	$15,000.00
August 18, 1894	5,000.00
June 3, 1896	5,000.00
Total	25,000.00

U 8.

OPERATING AND CARE OF GALVESTON AND BRAZOS CANAL.

Watchmen were stationed at the canal during the year for operating the drawbridge over the canal and tending log boom at mouth of canal.

The drawbridge over the canal needs repairing, or should be replaced by a new bridge which would cost about $1,000.

The depth in the canal is about 18 inches.

For improvement of this canal see page 1502 of this report.

Amount expended during the fiscal year was as follows:

Watchmen	$331.66
Rubber stamps, blanks, etc	2.56
Total	334.22

Money statement.

Allotted July 19, 1904	$1,030.00
June 30, 1905, amount expended during fiscal year	334.23
July 1, 1905, balance unexpended	695.77
July 1, 1905, outstanding liabilities	35.00
July 1, 1905, balance available	660.77

ALLOTMENT FOR GALVESTON AND BRAZOS CANAL.

July 19, 1904	$1,030

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U 9.

IMPROVEMENT OF BRAZOS RIVER, TEXAS, FROM VELASCO TO OLD WASHINGTON.

(A) BRAZOS RIVER (VELASCO TO RICHMOND).

OPERATIONS DURING THE YEAR.

The work done during the fiscal year consisted in dredging at various places by the U. S. snag boat *Captain C. W. Howell* to such depths as to allow her to proceed to Richmond, Tex.

It is proposed to expend the remaining balance during the coming year, when the plant now working in the river reaches this section.

Money statement.

July 1, 1904, balance unexpended	$4,477.22
June 30, 1905, amount expended during fiscal year, for works of improvement	1,103.34
July 1, 1905, balance unexpended	3,373.88

APPROPRIATION.

June 3, 1896	$5,000

COMMERCIAL STATISTICS.

There is only a limited commerce on this part of the river at present, of which exact statistics were not obtained.

(B) BRAZOS RIVER, TEXAS, FROM VELASCO TO OLD WASHINGTON.

OPERATIONS DURING THE YEAR.

The preliminary snagging of the channel from Richmond to Old Washington was completed.

The stern-wheel snag boat *Captain C. W. Howell* was completed and fitted with a dredge bucket and has been used as a dredge.

With funds already appropriated the entire reach from Old Washington to Richmond has had a preliminary snagging, and two-thirds of the jetties contemplated between Hempstead and Richmond have been constructed. With remaining balance it is expected that unless the flood conditions are unusually severe the snagging will be extended from Richmond to Velasco, and the number of jetties contemplated by the project will be completed from Hempstead to Velasco, and that a narrow cut can be dredged through many if not all of the remaining shoals.

High water in the river greatly retarded the work during the year.

The total expenditure during the fiscal year has been $72,087.39, of which sum $59,525.60 was expended for jetty work, and $12,761.79 for dredging. These sums include the cost of building and preparing the plant for the work.

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Further details of the work are given in report of Mr. Chas. Schuster, superintendent, forwarded herewith.

Project for the expenditure of funds appropriated by act of March 3, 1905, was submitted and approved.

With the balance available on June 30, 1905, and additional appropriation recommended it is proposed to complete and maintain the project. In this connection attention is invited to the fact that the river is subject to big floods and caving banks, and that the officer submitting the project under which work is being done, estimated that $40,000 a year would be needed to maintain the river from Old Washington to the mouth. Congress appropriated only $25,000 this last year. If the result desired is to be attained and maintained, more liberal appropriations must be made.

Money statement.

July 1, 1904, balance unexpended		$105,242.08
Amount appropriated by river and harbor act approved March 3, 1905		25,000.00
Refundment by civilian employee		.25
		130,242.33
June 30, 1905, amount expended during fiscal year, for works of improvement		77,292.75
July 1, 1905, balance unexpended		52,949.58
July 1, 1905, outstanding liabilities		3,542.10
July 1, 1905, balance available		49,407.48
Amount (estimated) required for completion of existing project		50,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$50,000.00	
For maintenance of improvement	30,000.00	
		80,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

ABSTRACT OF APPROPRIATIONS.

June 13, 1902	$150,000
March 3, 1905	25,000
Total	175,000

In addition to above appropriations there has been refunded by civilian employee 25 cents, making a total of $175,000.25.

CONTRACT IN FORCE.

Emergency contract.

Contractor: Sabine Tram Company, Beaumont, Tex.

Character of work: Furnishing and delivering at either Dyer or Orchard, Tex., longleaf yellow-pine lumber.

Rate: 5 by 8 inches by 24 feet, at $15 M feet B. M.; 3 by 12 inches by 16 feet, at $15.50 M feet B. M.

Date of approval: Emergency contract.

Date of beginning work: No definite date. Ordered in carload lots as required.

Date of expiration: No time set. Contract in force until all the lumber has been ordered and accepted.

Contract completed.

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COMMERCIAL STATISTICS.

There is at present very little commerce on the river, except on the lower reaches.

REPORT OF MR. CHAS. SCHUSTER, SUPERINTENDENT.

GALVESTON, TEX., *July 13, 1905.*

CAPTAIN: I have the honor to submit the following report of work done on Brazos River, Texas, between Richmond and Old Washington, during the fiscal year ending June 30, 1905:

DREDGING.

The stern-wheel snag boat *Captain C. W. Howell* was completed and put in commission September 13, 1904. The boat was fitted with an orange-peel dredge bucket of 1 cubic yard capacity, and has been used as a dredge principally in rock and clay after the material was blasted. The width of the dredged cut was made about 40 feet, and 2,210 feet in length have been dredged between miles 116.5 and 118.5, and 881 feet at mile 154, and 15 feet at mile 153.

Recently the orange-peel bucket was transferred to the hoister *Navasota* and the *Captain C. W. Howell* equipped with a clam-shell bucket of 2 cubic yards capacity, and it is intended in the future to use the *Navasota* for dredging through the rock shoals and the *Captain C. W. Howell* in sand and clay.

JETTY WORK.

In the report on survey of Brazos River between Richmond and Old Washington (see Annual Report of the Chief of Engineers for 1901, Appendix U, p. 2006) the existence of 33 shoals is reported in this section of the river, but a reconnaissance made in December, 1904, revealed the existence of 106 shoals having less than 3 feet of water on crest at low water. Of this number, 21 of the worst shoals were selected for improvement, and to date the following shoals have been improved:

	Ft. long.
Pile and plank jetty:	
Sand shoal at mile 112	1,010
Sand shoal at mile 114	465
Sand shoal at mile 117.5	409
Sand and gravel shoal at mile 119	312
Pile and brush jetty:	
Sand shoal at mile 120	240
Gravel shoal at mile 142.6	305
Sand shoal at mile 148 (2)	2,110
Sand shoal at mile 149.5	280
Sand shoal at mile 158	1,460
Sand shoal at mile 189.5	222
Sand shoal at mile 191	114
Rock jetty:	
Rock shoal at mile 118.5	100
Rock shoal at mile 120	358
Rock shoal at mile 154	186

And 120 feet pile and brush jetty at mile 189.5 and 50 feet at mile 191 are partly completed. Material has been prepared for jetties at miles 132, 143, 189½, 191, and 186.6. Rock was drilled and blasted preparatory to dredging on the rock shoals at miles 104, 112, 120, 123, 154, and 251.8. A point of stiff, sandy clay, which projected into the river at mile 114, was blasted and 700 cubic yards of clay removed.

Very respectfully, your obedient servant,

CHAS. SCHUSTER,
Superintendent.

Capt. EDGAR JADWIN,
Corps of Engineers.

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U 10.

IMPROVEMENT OF THE MOUTH OF BRAZOS RIVER, TEXAS.

OPERATIONS DURING THE YEAR.

No work was done during the year.

Project for the expenditure of funds appropriated and authorized to be contracted for by the act of March 3, 1905, was submitted and approved. Bids for jetty work were advertised for May 29, 1905, and opened June 28, 1905. The bid of Charles Clarke & Co., of Galveston, Tex., was recommended for acceptance.

The balance available on June 30, 1905, and additional appropriation recommended, it is proposed to apply to repairing the jetties and to bank protection in the river.

Money statement.

July 1, 1904, balance unexpended	$5,419.01
Amount appropriated by river and harbor act approved March 3, 1905	50,000.00
	55,419.01
June 30, 1905, amount expended during fiscal year, for works of improvement	131.58
July 1, 1905, balance unexpended	55,287.43
July 1, 1905, outstanding liabilities	43.24
July 1, 1905, balance available	55,244.19
Amount (estimated) required for completion of existing project	225,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	225,000.00

ABSTRACT OF APPROPRIATIONS.

June 14, 1880	$40,000	March 3, 1899	$85,000
March 3, 1881	40,000	June 13, 1902	50,000
August 2, 1882	50,000	March 3, 1905	50,000
July 5, 1884	10,000		
August 5, 1886	18,750	Total	343,750

In addition to the above appropriations by Congress there has been received $8.66 from sales of condemned property, making a total of $343,758.66.

COMMERCIAL STATISTICS.

No commercial statistics for the fiscal year ending June 30, 1905, could be obtained.

U 11.

IMPROVEMENT OF ARANSAS PASS AND BAY, TEXAS.

OPERATIONS DURING THE FISCAL YEAR—JETTY WORK.

Work of strengthening and completing the north jetty was carried on under contract entered into April 6, 1903, and approved April 20, 1903, with Henry Clay Ripley, of Ann Arbor, Mich.

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During the year 10,751.33 tons of stone were placed in the jetty. Work under this contract was completed September 17, 1904.

REMOVING PART OF OLD GOVERNMENT JETTY.

At the beginning of the fiscal year the inspection of work of removing part of the old Government jetty, under contract entered into April 22, 1903, and approved May 13, 1903, with Moore & Sieber, of Texas City, Tex., was being made. Borings taken over the site of the work showed that 1,000 feet of the old jetty had been completely removed to a depth of 25 feet between station 62, north jetty, and station 750, of old Government jetty, leaving a clear waterway of over 800 feet between the old and new work.

SURVEY.

Survey of Aransas Pass from 30 feet of water in the Gulf of Mexico to 30 feet depth in the harbor above the gorge was made during September and October, 1904; also cross sections over the jetty. A map of the survey is herewith.

Further details of the work are given in the report of Mr. S. M. Wilcox, assistant engineer, forwarded herewith.

The balance available on June 30, 1905, and additional appropriation recommended, it is proposed to apply to completing the Haupt jetty.

Project for the expenditure of funds appropriated by act of March 3, 1905, and authorized to be contracted for by this act, was submitted and approved. Bids for the work were advertised for May 29, 1905, and opened June 28, 1905. The bid of Charles Clarke & Co., of Galveston, Tex., was recommended for acceptance.

Money statement.

July 1, 1904, balance unexpended		$133,352.59
Amount appropriated by river and harbor act approved March 3, 1905		100,000.00
		233,352.59
June 30, 1905, amount expended during fiscal year, for works of improvement		128,606.06
July 1, 1905, balance unexpended		104,746.53
July 1, 1905, outstanding liabilities		43.23
July 1, 1905, balance available		104,703.30
Amount (estimated) required for completion of existing project		1,330,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905		[a] 100,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.		

[a] If project is only for completion of Haupt jetty. If it is intended to work on both jetties, $400,000 can be profitably expended.

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ABSTRACT OF APPROPRIATIONS.

March 3, 1879	$35,000	August 11, 1888	$100,
June 14, 1880	65,000	March 3, 1899	60,
March 3, 1881	80,000	June 13, 1902	250,
August 2, 1882	100,000	March 3, 1905	100,
July 5, 1884	100,000		
August 5, 1886	101,250	Total	991,

CONTRACTS IN FORCE DURING FISCAL YEAR.

Contractor: Henry Clay Ripley, Ann Arbor, Mich.
Character of work: Jetty.
Rates:
Small riprap placed in the jetty, $3.75 per ton.
Large riprap (granite) placed in the jetty, $4.60 per ton.
Large riprap obtained in the quarrying of small riprap placed in the je
$4.25 per ton.
Large blocks placed in the jetty, $5.10 and $5 per ton.
Date of approval: April 20, 1903.
Date of beginning work: July 23, 1903.
Date of expiration: Time limit waived; completed September, 1904.

Contractor: Moore & Sieber, Texas City, Tex.
Character of work: Removing portion of old Government jetty.
Rates: $46,000.
Date of approval: May 13, 1903.
Date of beginning work: August 23, 1903.
Date of expiration: Time limit waived; completed July, 1904.

COMMERCIAL STATISTICS.

No commercial statistics for the fiscal year ending June 30, 1905, could be obtain
Inquiries by letter were made, but no replies have been received up to June
1905.

REPORT OF MR. S. M. WILCOX, ASSISTANT ENGINEER.

GALVESTON, TEX., *July 15, 190*

CAPTAIN: I have the honor to submit the following report on the improvemen
Aransas Pass, Tex., for the fiscal year ending June 30, 1905:

CONDITION OF THE WORK.

At the completion of the H. C. Ripley contract, condition of the jetty wa
follows:

From station—	To station—	Distance.	Elevation above or be mean low tide.
		Feet.	*Feet.*
0	20	2,000	0 to −4.
20	24+50	450	− 1.
24+50	27	250	−13 (gap).
27	40	1,300	+ 4 (old work).
40	50	1,000	0 to +4.
50	55+75	575	0 to −4.
55+75	56+60	85	0 (ready for block).
56+60	76+50	1,990	+ 4 (completed).

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OPERATIONS DURING THE FISCAL YEAR.

The contract with H. C. Ripley was completed September 17, 1904. Since last annual report the following quantities of stone were placed in jetty:

	Tons.	Rate per ton.	Amount.
Small riprap	1,909.69	$3.75	$7,161.34
Large riprap (limestone)	68.27	4.25	290.15
Large riprap (granite)	6,992.61	4.60	32,166.00
Granite blocks	1,680.76	5.10	8,816.88
Do	150.00	5.00	750.00
Total	10,751.33	.....	48,684.37
Previously placed	36,113.54	.....	147,668.32
Total of contract	46,864.87	.....	196,352.69

One thousand four hundred and ninety feet of jetty were completed between station 56+60 and station 71+50, leaving 85 feet between station 55+75 and station 56+60 unprotected with crest blocks.

Very respectfully, your obedient servant,

S. M. WILCOX,
Assistant Engineer.

Capt. EDGAR JADWIN,
Corps of Engineers.

U 12.

IMPROVEMENT OF HARBOR AT BRAZOS SANTIAGO, TEXAS.

OPERATIONS DURING THE YEAR.

Bids for dredging were advertised for August 23, 1904, and opened September 22, 1904. Contract was entered into with the Bowers Southern Dredging Company, of Galveston, Tex., October 19, 1904, and approved November 4, 1904. Active operations were carried on under this contract during the year, and a channel 70 feet wide on the bottom, with a least depth of 10 feet and side slopes of 1 on 2, was excavated from deep water inside the bar in a straight line across the Laguna Madre to the railroad wharf at Isabel, Tex., a distance of 12,000 feet; also a turning basin 400 feet long by 300 feet wide and 10 feet deep.

Statement of material excavated and removed, with cost of same, during the year ending June 30, 1905.

Location.	Quantity.	Rate per cubic yard.	Total cost.
	Cubic yds.	*Cents.*	
Prescribed cross section	215,581	19½	$42,088.30
Below prescribed cross section	41,590	9½	4,055.03
Total	257,171	.....	46,093.33

This contract was completed June 30, 1905.

The balance available on June 30, 1905, and additional appropriation recommended, it is proposed to apply to maintaining the dredged channel and constructing jetties, provided a sufficient area of land at the root of the jetties is given to the United States.

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Money statement.

July 1, 1904, balance unexpended	$54,785.39
June 30, 1905, amount expended during fiscal year, for works of improvement	34,760.67
July 1, 1905, balance unexpended	20,024.72
July 1, 1905, outstanding liabilities	14,193.06
July 1, 1905, balance available	5,831.66
Amount (estimated) required for completion of existing project	1,071,090.23
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:	
For works of improvement	$400,000.00
For maintenance of improvement	40,000.00
	440,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

ABSTRACT OF APPROPRIATIONS.

June 14, 1880	$25,000	August 5, 1886	$37,500
March 3, 1881	75,000	August 11, 1888	25,000
August 2, 1882	60,000		
July 5, 1884	25,000	Total	247,500

CONTRACT IN FORCE.

Contractor: Bowers Southern Dredging Company, Galveston, Tex.
Character of work: Dredging.
Rate: 19½ cents per cubic yard.
Date of approval: November 4, 1904.
Date of beginning work: January 15, 1905.
Date of expiration: May 15, 1905. Time limit waived. Completed June 30, 1905.

COMMERCIAL STATISTICS.

Arrived:		
Number of vessels		30
Lumber	tons	1,112
General merchandise	do	3,075
Total	do	4,187
Departed:		
Number of vessels		16
Cotton	tons	53
Rice and rice products	do	543
Hides and bones	do	688
Miscellaneous	do	26
Total	do	1,310
Grand total		5,497

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SKETCH

SHOWING LOCATION OF DREDGED CHANNEL

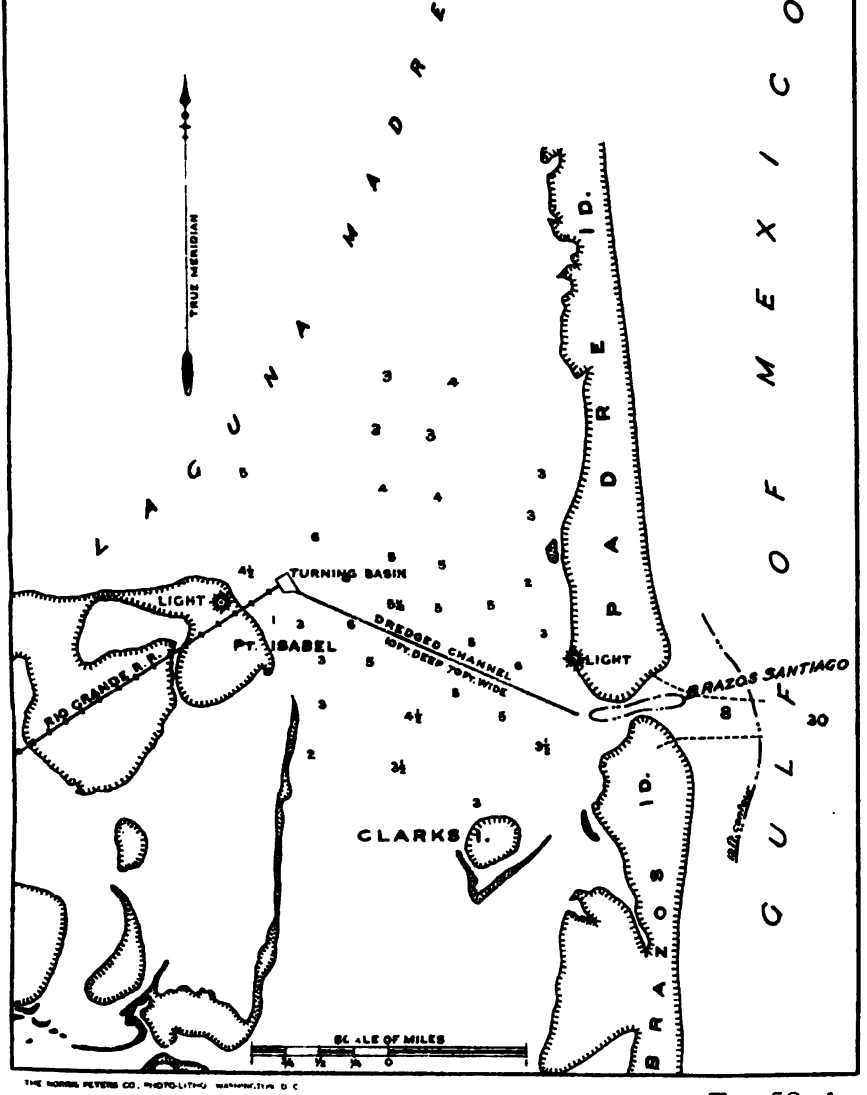
AT

BRAZOS SANTIAGO, TEXAS.

MADE UNDER THE DIRECTION OF

CAPTAIN EDGAR JADWIN, CORPS OF ENGRS. U.S. ARMY

JULY 1905



THE HORNER PETERS CO. PHOTO-LITHO WASHINGTON D.C.

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U 13.

CONSTRUCTION OF SEA WALL, EMBANKMENT, AND FILL ALONG THE FRONT OF THE FORT CROCKETT RESERVATION, GALVESTON, TEXAS, AND CONSTRUCTING SEA WALL FROM THIRTY-NINTH STREET TO THE WEST LINE OF FORTY-FIFTH STREET IN THE CITY OF GALVESTON.

OPERATIONS DURING THE YEAR.

Bids for constructing the sea wall were advertised for July 25, 1904, opened August 24, 1904. Contract entered into with J. M. O'Rourke & Co., of Galveston, Tex., September 28, 1904, and approved October 14, 1904.

During the year contractors removed the riprap and sand and soil protection from the flanks of the batteries on Fort Crockett Reservation to connect the wall with the battery. 4,850 foundation piles driven, completing same. 4,667 sheet piles driven, 234 linear feet to be driven to complete. 4,222.49 linear feet concrete base completed, 631 linear feet to be placed to complete. 2,057.55 linear feet of wall completed between Thirty-ninth and Forty-fifth streets, 359 linear feet to be placed to complete wall to east boundary of Fort Crockett Reservation. 807.08 linear feet of wall completed on Fort Crockett Reservation, 1,673 linear feet to be placed to complete. 19,972.76 tons riprap apron unloaded and placed in front of wall, 1,100 feet to be placed to complete.

To close of year the title to the land lying between Thirty-ninth and Forty-fifth streets in the city of Galveston, to be deeded to the United States, had not been perfected, and no payment has been made for work done on this land.

Bids for constructing a riprap revetment from the end of the sea wall at the western boundary of Fort Crockett Reservation, thence northerly 1,245 feet to the northern boundary of the reservation, were advertised for May 23, 1905, by poster and circular letter (ten days' public notice), and opened June 2, 1905. Contract was entered into with Isaac Heffron, of Galveston, Tex., June 12, 1905, and approved June 26, 1905. No work has been done under this contract to the close of the year.

Money statement.

July 1, 1904, balance unexpended	$591,046.25
June 30, 1905, amount expended during fiscal year, for works of improvement	43,706.17
July 1, 1905, balance unexpended	547,340.08
July 1, 1905, outstanding liabilities	44,956.94
July 1, 1905, balance available	502,383.14
July 1, 1905, amount covered by uncompleted contracts	225,048.94

ABSTRACT OF APPROPRIATIONS.

April 28, 1904	$591,046.25

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CONTRACTS IN FORCE.

Contractor: J. M. O'Rourke & Co., Galveston, Tex.
Character of work: Constructing sea wall.
Rates:
Round piling 19 cents linear foot in completed structure, including trenching and back filling.
Sheet piling $25 per 1,000 feet, B. M., including all necessary fastening in completed structure.
Reinforcing and anchor rods 4 cents per pound in completed structure.
Vitrified pipe 95 cents per linear foot in completed structure.
Concrete $5.75 per cubic yard in completed structure.
Riprap $1.90 and $2 per ton, in place.
Date of approval: October 14, 1904.
Date of beginning work: December 17, 1904.
Date of expiration: Time limit waved.

Contractor: Isaac Heffron, Galveston, Tex.
Character of work: Riprap revetment.
Rate: $2.10 per ton, 5 cents per ton deducted for all material handled by United States plant.
Date of approval: June 24, 1905.
Date of beginning work: July 15, 1905.
Date of expiration: September 13, 1905.

U 14.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

The hurricane of September 8, 1900, strewed the waters of West Galveston Bay with wrecks of boats, beacons, and bridges, and same has become a menace to navigation.

An allotment of $2,500 was made during the fiscal year from the indefinite appropriation made by section 20 of the river and harbor act of March 3, 1899, for the expenses of removing these wrecks from the navigable waters of West Galveston Bay.

At the close of the fiscal year the U. S. snag boat *Gen. S. M. Mansfield* had removed 6 round piles, 21 iron pipes, 5 bridge spans, and the turntable of the county of Galveston bridge.

U 15.

MODIFICATION OF HARBOR LINES IN MATAGORDA BAY AT PORT LAVACA, TEXAS.

PORT LAVACA, TEX., *June 6, 1904.*

DEAR SIR: We, the undersigned, citizens of Port Lavaca, Tex., respectfully request that the harbor line of this port be extended 150 feet farther out into the bay, for the following reasons:

Because at present line during low tides there is not sufficient water to allow our larger vessels to reach the various wharves.

Because the prosperity of our whole community depends largely upon the fish and oyster trade carried on at this place.

By granting this extension you will confer a favor upon all the business interests at this port.

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F. V. Gentry, wholesale fish and oysters.
T. H. Clement, wholesale fish and oysters.
C. Warrach, jr., wholesale fish and oysters.
J. A. Michot & Sons, wholesale feed and fuel.
A. S. Powers, merchant.
Rahtgens & Smith, lumber dealers.
Dudgran & Ullrich, grocers.
John B. Mahon, general merchandise.
J. C. Strong, merchant.
J. D. Crain, grocer.
Coast Lumber Company, lumber and hardware.
The Bay Trading Company, wholesale grocers.
P. Paulsen, furniture and hardware.
Charles Robert, postmaster.

I hereby indorse the petition of the citizens to extend the harbor line, as it is impossible during the winter months for some of the vessels to reach the various wharves.

JACOB HIRSCH,
Deputy Collector of Customs.

Hon. WILLIAM H. TAFT,
Secretary of War.

[Second indorsement.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, July 5, 1904.

Respectfully referred to Capt. Edgar Jadwin, Corps of Engineers, for report.

To be returned.

By command of Brig. Gen. Mackenzie:

H. F. HODGES,
Major, Corps of Engineers.

[Third indorsement.]

NEW YORK, N. Y., *August 23, 1904.*

Respectfully returned to the Chief of Engineers, United States Army.

The present harbor line was established in accordance with report and recommendation of Capt. C. S. Riché, Corps of Engineers, dated September 18, 1901, and approved September 28, 1901, the report being made after public hearing.

Correspondence has failed to bring to light any objection to the proposed extension of the harbor line, which is believed to be in the interest of navigation.

An advance of 150 feet, as requested by the petitioners and as shown on the accompanying blueprint[a] in red, is therefore recommended.

EDGAR JADWIN,
Captain, Corps of Engineers.

[Fourth indorsement.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, September 2, 1904.

Respectfully returned to the Secretary of War.

Request is made for modification of the established harbor line at Port Lavaca, Tex., by locating the same a distance of 150 feet farther out in the bay.

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[a] Not printed.

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From the report of the local engineer officer, in third indorsement hereon, it appears that correspondence has failed to bring to light any objection to the proposed extension of the harbor line, which is believed to be in the interest of navigation.

Concurring in the views of the local officer, I recommend that the modified harbor line, as requested, be approved.

The proposed change has been indicated on the tracing[a] showing the original lines, which tracing has been prepared for the signature of the Secretary of War.

H. F. HODGES,
Acting Chief of Engineers.

[Fifth indorsement.]

WAR DEPARTMENT,
September 6, 1904.

Approved as recommended by the Acting Chief of Engineers.

ROBERT SHAW OLIVER,
Acting Secretary of War.

[a] Not printed.

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APPENDIX V.

IMPROVEMENT OF CERTAIN RIVERS AND WATERWAYS IN LOUISIANA, TEXAS, ARKANSAS, INDIAN TERRITORY, AND MISSISSIPPI, TRIBUTARY TO MISSISSIPPI RIVER.

REPORT OF CAPT. G. M. HOFFMAN, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1905, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Red River, Louisiana, Arkansas, Texas, and Indian Territory.
2. Cypress Bayou, Texas and Louisiana.
3. Ouachita and Black rivers, Arkansas and Louisiana.
4. Bayou Bartholomew, Boeuf River, Tensas River and Bayou Maçon, and bayous D'Arbonne and Corney, Louisiana and Arkansas.
5. Mouth of Yazoo River and Harbor at Vicksburg, Mississippi.
6. Yazoo, Tallahatchie, Coldwater, and Big Sunflower rivers, and Tchula Lake, Mississippi.

UNITED STATES ENGINEER OFFICE,
Vicksburg, Miss., July 18, 1905.

GENERAL: I have the honor to send herewith annual reports for the fiscal year ending June 30, 1905, upon the works of river and harbor improvement of the Vicksburg, Miss., district.

This district was in the charge of Lieut. Col. H. M. Adams, Corps of Engineers, to July 8, 1904, and of Capt. J. F. McIndoe, Corps of Engineers, after that date until December 10, 1904, when it was transferred to me under Special Orders, No. 280, paragraph 18, dated War Department, November 29, 1904.

Very respectfully, your obedient servant,

G. M. HOFFMAN,
Captain, Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

V 1.

IMPROVEMENT OF RED RIVER, LOUISIANA, ARKANSAS, TEXAS, AND INDIAN TERRITORY.

GENERAL IMPROVEMENT.

The repairs of the U. S. snag boat *C. W. Howell*, Robert Elflein, master, at New Orleans, La., in progress June 30, 1904 (see Report Chief of Engineers, 1904, p. 2030), were completed July 28. The boat

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was docked, the steel hull was scraped and repainted with two coats of red lead and oil, two new balance rudders were built and riveted in position, and other minor repairs were made.

On August 1 the *Howell* resumed work in Lower Red River and from that date to February 1 was employed in removing obstructions to navigation between the head of Atchafalaya River and Shreveport, La., 320.5 miles. On February 4 the boat's chimneys were lowered and it passed up under the fixed span of the Vicksburg, Shreveport and Pacific Railway bridge at Shreveport—the depth under the draw span not being sufficient—and was employed between Shreveport, La., and Fulton, Ark., 188.1 miles, until March 26, when it was laid up at Shreveport on account of the high stage of the river. While out of commission, awaiting favorable conditions for resuming snagging work, new capstan machinery was installed, new wooden shears were made and erected, and the woodwork of the vessel was repainted where necessary for proper preservation.

Operations of the *Howell* below Fulton, Ark., were resumed June 20, and from June 20 to 30 the boat worked downstream 54¼ miles, from Fulton to Avery, Ark.

The following is a summary of the work performed by the *Howell* below Fulton, Ark., during the year:

Snags pulled and destroyed	1,670
Stumps pulled, cut, and destroyed	904
Shore snags cut	1,763
Side jams broken up and destroyed	3
Logs removed from channel and cut up	644
Leaning trees felled and cut up	2,540
Trees girdled	88
Hard clay point (at head of Wilson Cut-off, La.,) blasted, to afford more room for boats entering and leaving	1

Reference is invited to the appended report of Mr. H. M. Marshall, assistant engineer.

From December 25 to May 11 the party under Overseer C. D. Banks, equipped with tools, explosives, etc., worked from Fulton, Ark., downstream 132 miles to near Hervey Canal, Louisiana, and removed the following obstructions to navigation:

Channel snags cut and destroyed	589
Shore snags cut and destroyed	2,024
Leaning trees felled and cut up	17,431

ABOVE FULTON, ARK.

The work in progress June 30, 1904 (see Report Chief of Engineers, 1904, p. 2031), was continued. On account of ill health, Overseer Cason was succeeded by Overseer C. D. Banks August 1. Quarter boat *No. 5* was cordeled upstream and reached the mouth of Kiamichi River, Indian Territory, about 170 miles above Fulton, Ark., August 19. From August 20 to December 24 the party worked downstream to Fulton.

The following is a summary of the work performed July 1 to December 24, 1904:

Channel snags cut and destroyed	1,418
Shore snags cut	5,842
Leaning trees felled and cut up	10,077
Wrack heaps destroyed	4

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From May 12 to 18, 1905, quarter boat *No. 5* was towed by the U. S. snag boat *C. W. Howell* from Hervey Canal, Louisiana, to Davenport, Tex., about 10 miles below the mouth of Kiamichi River, as far upstream as it was considered safe for the snag boat to proceed on the existing stage.

The snag boat was employed above Fulton until June 19, 1905, and removed the following obstructions to navigation:

Snags pulled	66
Stumps pulled	2
Shore snags cut	1
Leaning trees felled and cut up	404

From May 19 to June 20 quarter boat *No. 5* was cordeled upstream from Davenport to Pine Bluff Ferry, Texas, about 30 miles above the Kiamichi River, and from June 20 to 30 the party worked back downstream 19 miles. The following work was performed from May 19 to June 30:

Snags pulled and destroyed	520
Stumps pulled and destroyed	18
Shore snags cut	1,473
Jams broken up and destroyed	2
Leaning trees felled and cut up	11,129
Trees girdled	65
Square yards of willows and brush cut	1,250

Construction of two light quarter boats at Denison Landing, Texas, was commenced by Supt. George C. Thomas June 24, and a third boat was commenced June 28 at Arthur City, Tex., for use of additional parties to be employed in July above Fulton, Ark., to Denison, Tex.

AT SHREVEPORT, LA.

The work of repairing and extending an old dike and of building two new dikes at this locality, under modified project approved November 27, 1903 (see Report Chief of Engineers, 1904, p. 2031), was completed December 17, 1904. It was carried on under the local direction of Asst. Engineer Walter H. Polk, whose report is appended, and to which reference is invited.

The cost of this work was as follows:

Amount expended in fiscal year—	
1904	$669.22
1905	5,947.14
Total	6,616.36

The original estimate of cost was $5,000. An additional expenditure of $2,500 was authorized September 6, 1904.

Soundings made since the flood stage the early part of June show a considerable fill at each of the three dikes, except at end of Dike No. 2, where a scour has taken place. A cross section sounded 150 feet above Dike No. 1 shows that the channel has shifted to the opposite side of the river. Under the draw span of the Vicksburg, Shreveport and Pacific Railway bridge the bar had scoured extensively, increasing the depth about 7 feet. Indications are that the object of the dikes, to cause the low-water channel to pass through the draw of the bridge, has been accomplished; this was largely contributed to by the rapid caving back of the point on the east bank immediately above.

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ESTIMATES.

The amounts expended during the year and the unexpended balances July 1, 1905, were as follows:

Allotments.	Expended during year.	Balances unexpended July 1, 1905.
General improvement	$24,984.72	$127,954.45
Above Fulton, Ark	7,737.68	96,764.23
At Shreveport, La	5,947.14	9,393.04
At Alexandria, La		15,000.00
Total	38,669.54	249,111.72

The river and harbor act approved March 3, 1905, required the expenditure of $100,000 between Fulton, Ark., and Denison, Tex., and authorized the expenditure of $15,000 for improvement of the channel at Alexandria, La., in the discretion of the Secretary of War.

The unexpended balances are to be applied to the purposes designated in the column of allotments, and it is believed that they will be sufficient for two years' work. For this reason no additional estimate is made for the fiscal year ending June 30, 1907.

Money statement.

July 1, 1904, balance unexpended		$87,613.07
Amount appropriated by river and harbor act approved March 3, 1905		200,000.00
Amount received from sales of condemned property and from overpayments in fiscal year 1904		[a] 168.19
		287,781.26
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$5,947.14	
For maintenance of improvement	32,722.40	
		38,669.54
July 1, 1905, balance unexpended		249,111.72
July 1, 1905, outstanding liabilities		2,656.85
July 1, 1905, balance available		246,454.87

The appropriations for the early work, from 1828 to 1852, were as follows:

May 23, 1828	$25,000.00	March 3, 1841	$75,000.00
March 2, 1831	187.50	March 2, 1847	7,150.00
July 3, 1832	22,628.00	August 30, 1852	100,000.00
June 28, 1834	50,000.00		
March 3, 1835	50,000.00	Total	535,765.50
July 2, 1836	40,800.00	Amount expended	532,219.90
	30,000.00		
March 3, 1837	65,000.00	Amount carried to surplus fund	3,545.60
April 20, 1838	70,000.00		

[a] Eighty cents deposited September 14, 1904, account of overpayments made during preceding fiscal year.

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The appropriations since 1872 have been as follows:

June 10, 1872	$20,000	August 5, 1886	$75,000
	150,000		7,000
March 3, 1873	80,000	August 11, 1888	65,000
June 23, 1874	50,000		35,000
March 3, 1875	20,000		3,000
August 14, 1876	35,000	September 19, 1890	100,000
April 10, 1869 [a]	4,500		28,000
February 7, 1878	6,000		2,000
June 18, 1878	24,000	July 13, 1892	145,000
	25,000		3,500
March 3, 1879	15,000	August 18, 1894	150,000
	22,500		3,500
	10,000	June 3, 1896	100,000
	25,000		3,000
June 14, 1880	60,000	March 3, 1889	150,000
	10,000	June 13, 1902	135,000
March 3, 1881	10,000	March 3, 1905	200,000
	10,000		
August 2, 1882	75,000	Total	1,932,000
July 5, 1884	75,000		

COMMERCIAL STATISTICS.

Navigation of Red River above the Atchafalaya River, Louisiana, to Fulton, Ark., was not suspended during the year. At lowest stages New Orleans packets did not run above Alexandria, La.

List of steamboats in the Red River trade during the fiscal year.

Name.	Class.	Tonnage.	Length.	Breadth.	Depth.	Draft.		Between—	Round trips.	Passengers.
						Light.	Loaded.			
			Feet.	*Feet.*	*Feet.*	*Feet.*	*Feet.*			
Electra	Stern-wheel.	272	170	35	5.2	2.3	7.1	New Orleans and Shreveport, La.	.....	.....
F. Weyerhauser [b]	....do....	216	140	31	4.5	3.0	4.5	Baton Rouge and local points.	3	....
Will Davis [b c]	....do....	150	101	24	3.6	1.7	2.2	Not reported	.....	.....
H. M. Carter [d]	....do....	97	156	28	6.0	1.6	5.0	New Orleans and Shreveport.	23	690
Roberta	....do....	94	135	26	4.0	2.5	6.0	.....do.....	11	188
H. C. Brockman [b]	....do....	75	91	22.6	3.8	2.0	3.0	Baton Rouge and local points.	.....	.....
Geo. L. Bass	....do....	53	91	21	3.3	1.5	3.5	Boyce and local points.	16	....
Will H. Wood	....do....	44	72	16.6	7.6	.....	.....	Not reported	.....	.....
Annie P	....do....	55	.....	.....	.....	1.0	2.5	Denison and Shreveport.	1	....
Kingfisher [c]	....do....	27	75	16.1	2.5	1.7	2.1	Fulton and local points.	.....	.....
Advance [b c]	....do....	17	69	11.2	2.9	2.0	3.0	Shreveport and local points.	8	....
Blue Eagle	Gasoline.	14	40	12	.....	1.3	2.5	Garland and local points.	40	330
Lola	.....	8	.....	.....	.....	.....	.....	Barbre and Lake Landing.	66	....
Typo	Launch	.....	28	.....	.....	2.0	2.2	Shreveport and local points.	8	80
King Bee	.....	8	.....	.....	.....	4.5	5.5	Simmesport and Lake Long.	.....	.....

[a] Allotment made August 27, 1877, for closing Tones Bayou. [b] Towboat.
[c] With one or more barges. [d] Sunk at Alexandria June 2. [e] Sunk at Fulton in June.

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Summary of commerce reported.

Articles.	1904–5.	Articles.	1904–5.
	Tons.		*Tons.*
Cotton	3,050	Provisions	2,886
Cotton seed	5,168	Grain	856
Live stock	83	Sand	51,000
Lumber	256	Miscellaneous	5,969
Saw logs	105,536		
Staves	66	Total	174,870

Estimated value $1,506,500.

A large part of the commerce of Ouachita and Black rivers passes up and down lower Red. During the fiscal year 1904–5 this aggregated 141,779 tons.

April 24, 1905, requests were sent to the boards of trade at Shreveport and Alexandria, La., for reliable information of the effect of the project upon freight rates. No response has been received from Shreveport, but the following letter was received from the Alexandria Progressive Union:

ALEXANDRIA, LA., *April 25, 1905.*

Capt. G. M. HOFFMAN.

DEAR SIR: Your favor of 24th instant, relative to rates to and from Alexandria by water and by rail has been referred to me.

As there is no board of trade in Alexandria and the Progressive Union has no information as to rates in question, would respectfully suggest that you take the matter up with W. M. Barrow, secretary railroad commission of Louisiana, Baton Rouge, La.

Mr. Barrow will furnish you with all the information you desire.

Yours, respectfully,

H. B. CHASE,
Secretary Alexandria Progressive Union.

A letter from the secretary of the railroad commission of Louisiana is appended. The questions referred to were interrogatories upon the following points, viz:

(1) The comparative rates by water and by rail upon staple commodities usually shipped by steamboats, such as cotton, cotton seed, and its products, staves, lumber, live stock, provisions, etc.

(2) The rates by rail for the same classes of freight shipped from and to inland towns some distance away from the river.

(3) Whether railroad rates are increased when navigation is suspended; and, if so, a comparative statement showing the increase at such times.

RAILROAD COMMISSION OF LOUISIANA,
Baton Rouge, May 2, 1905.

Capt. G. M. HOFFMAN,
Corps of Engineers.

DEAR SIR: We are sending you under separate cover copy of our report, which contains in detail information as to rates from the points you mention.

Answering your questions briefly:

(1) The rates from Alexandria, Shreveport, and Monroe on all commodities are lower than from intermediate points. Boat and rail rates are the same, which is generally the case at water competition points.

(2) Rates from intermediate points not on navigable streams are higher than rates from water competitive points.

(3) When navigation is suspended on Red River during certain seasons of the year, the river rates are higher than when this river is navigable. There is no other place in the State where this condition exists that I know of.

If the rates themselves will be of service, I will have them made.

Respectfully,

W. M. BARROW, *Secretary.*

From the statement of Hon. Allison Mayfield, member of the Texas railroad commission (published in the report of the Chief of Engineers, 1901, p. 2086), it appears that the inland cities of Marshall and Texarkana, Tex., are, to a certain degree, benefited by the water competition at Shreveport, La.

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REPORT OF MR. H. M. MARSHALL, ASSISTANT ENGINEER.

MONROE, LA., *June 30, 1905.*

CAPTAIN: I have the honor to submit the following report on the general improvement of Red River, Louisiana, Arkansas, Texas, and Indian Territory, during the fiscal year ending June 30, 1905.

At the beginning of the fiscal year the U. S. snag boat *C. W. Howell*, Robert Elflein, master, was in dry dock at New Orleans, La., undergoing repairs. The hull was painted outside with two coats of red lead and oil by the dock crew, and the rudders were altered and repaired by the boat's crew. She was let out of dock July 2, 1904, and painted in the hold and outside the cabin by the crew. After a pretty thorough overhauling she started for Red River July 28, and on August 1, soon after entering that river, it was discovered that the crown sheet of the boiler was blistered. The boat worked over the river hurriedly and arrived at Shreveport August 9, where repairs were immediately begun on the boiler, and finished August 16.

August 19 to December 10 the boat worked downstream from Shreveport to mouth of Black River. December 15 the boat made a trip to Simmesport and thence to Melville, La., on Atchafalaya, with Captains McIndoe and Hoffman on board.

Work then was carried upstream from the mouth to Shreveport, going above the bridge at that place February 4, 1905, the smokestacks being lowered to get under the fixed span where the channel was at that time. January 4 and 5 had been spent at Alexandria, making repairs to the capstan barrels, and January 20 and 21 were occupied going from Campti to Colfax, La., on an inspection trip made by the district officer.

February 23, 1905, while approaching the bridge at Shreveport, the smokestacks were hung on the telephone wires across the river and pulled down. February 24 to 26 were occupied making an inspection trip between Shreveport and Alban Canal No. 2 with the district officer on board, and March 24 and 25 in like manner between Fulton, Ark., and Shreveport, La.

Except when occupied, as stated, on the inspections the boat worked between Shreveport and Fulton until laid up at the former place for repairs March 26, 1905.

New shears were built, and new gears, spindle, and iron barrels were put in the capstans.

May 11, 1905, the *Howell* left Shreveport for the upper Red River, and from the 12th to the 18th was engaged towing U. S. quarter boat *No. 5* from Elmer Bayou to Davenport, Tex. The remainder of the fiscal year was spent in work above Fulton, Ark., except from May 29 to June 14, when the river was too high for operations, and the boat was laid up at Fulton; and from June 20 to 30, when work below Fulton was resumed.

During the high water, which reached a very high stage above Shreveport, much caving is reported to have taken place along the banks, and a cut-off was made at Peace Point, La.

At the beginning of the year the chopping party under Overseer J. B. Cason was at McCowen, Tex., 67 miles below mouth of Kiamichi. After the boat had been cordelled to the mouth of that river, work was carried on downstream to Elmer Bayou, Louisiana. On August 1, 1904, Overseer C. D. Banks was placed in charge, Overseer Cason having asked to be given indefinite furlough. After being towed by the *Howell* to Davenport, Tex., the boat worked up the river to Pine Bluff, about 30 miles above Kiamichi. During June it was under temporary charge of R. H. Armistead, and at the end of the year had worked back down to mouth of Kiamichi.

Mr. Geo. C. Thomas was made superintendent on upper Red River May 21, 1905, and has the lumber and material delivered for the construction of two quarter boats at Denison, and one at Arthur City, Tex.

The highest and lowest stages reached were as follows:

Station.	Highest reading.		Lowest reading.		Range.
	Date.	Feet.	Date.	Feet.	
	1905.		1905.		
Arthur City, Tex.[a]	May 31	25.0	Jan. 8-10	4.2	20.8
Fulton, Ark.[b]	June 1-3	31.5	Jan. 4-7	4.3	27.2
			1904.		
Shreveport, La.[b]	June 9	33.6	Dec. 22, 23	−1.8	35.4
Alexandria, La.[b]	June 16, 17	35.55	Dec. 22-25	−1.7	37.25

[a] Weather Bureau. [b] Mississippi River Commission.

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SHREVEPORT HARBOR.

Work at Shreveport Harbor was carried on under the immediate supervision of Assistant Engineer W. H. Polk, to whose report reference is made for the details of construction and to the profiles therewith for changes in depth. The work done and the change which has taken place on the point above the town seem to warrant the belief that caving along the city front above the bridge will cease. The channel has been restored to the east bank and is now under the draw span of the Vicksburg, Shreveport and Pacific Railway bridge.

Very respectfully, your obedient servant,

H. M. MARSHALL,
Assistant Engineer.

Capt. G. M. HOFFMAN,
Corps of Engineers.

REPORT OF MR. W. H. POLK, ASSISTANT ENGINEER.

SHREVEPORT, LA., *July 1, 1905.*

CAPTAIN: I have the honor to submit the following report on improving channel at Shreveport, La., during the fiscal year ending June 30, 1905:

Up to the beginning of the fiscal year 92 feet of dike had been completed; 32 piles had been driven in each of Dikes 1 and 2, and 45 piles in Dike 3, called for in project approved November 27, 1903.

On July 6, the river having reached a suitable stage, work was resumed at Dike 1, the upper of the three dikes. As the work progressed and the river receded the pile driver was shifted from dike to dike, completing as much at a time as the height of the river would permit. After completing the river end of Dike 3 the pile driver was shifted to the bank and the shore ends of the three dikes completed. On October 5 work was suspended awaiting a more favorable stage to complete the river end of Dikes 1 and 2. Work was resumed November 8 and dikes completed December 15.

Three hundred and twelve piles were driven in Dike 1, completing 110 linear feet of dike.

Two hundred and eighty-three piles were driven in Dike 2, completing 150 linear feet of dike.

Seven hundred and eighty piles were driven in Dike 3, completing 423 linear feet of dike.

Cost of dikes.

Piles and hardware	$2,313.43
Pay rolls	2,314.26
Hire and transportation of pile driver	1,703.58
Fuel, ice, and subsistence supplies	222.64
Mileage and traveling expenses	62.45
Total	6,616.36

Each dike, as completed, consists of a double row of piling so driven that the openings between piles of first row are partly closed by piles of second row, making a partially permeable dike. The dikes are about 300 feet apart along the bank line and point downstream at an angle of about 40°.

Soundings taken since the recent high water show a considerable fill at each of the three dikes, except at the end of Dike 2, where a scour has taken place. A cross section sounded 150 feet above Dike 1 shows that the channel has shifted from the dike side to the opposite side of the river. At the Vicksburg, Shreveport and Pacific Railway bridge a scour has taken place the entire width of cross section.

Very respectfully, your obedient servant,

WALTER H. POLK,
Assistant Engineer.

Capt. G. M. HOFFMAN,
Corps of Engineers.

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V 2.

IMPROVEMENT OF CYPRESS BAYOU, TEXAS AND LOUISIANA.

No work was done or expenditure made during the year.

The river and harbor act approved March 3, 1905, provided that (1) "the available balance on hand may, in the discretion of the Secretary of War, be expended in cleaning and clearing the bayou and lakes between Jefferson, Texas, and Mooringsport, Louisiana," (2) "and the Secretary of War is authorized and directed to survey Cypress Bayou and the channels connecting Shreveport, Louisiana, with Jefferson, Texas, including an examination of the falls near Little Pass." (Section 1 of the act requires that the expenses of the survey shall be paid from the appropriation made for the improvement.)

The first provision being discretionary and the second mandatory, with the approval of the Secretary of War, dated April 7, 1905, the survey is to be made, and the work of cleaning and clearing the bayou and lakes will be deferred until after its completion, as the available balance may not be sufficient for both purposes.

The survey will be commenced as soon as the conditions are favorable for such work, probably in July or August of this year.

Money statement.

July 1, 1904, balance unexpended	$3,202.66
July 1, 1905, balance unexpended	3,202.66

The appropriations for Cypress Bayou and the lakes have been as follows:

By act of—		By act of—	
June 10, 1872	$10,000.00	July 13, 1892 (for survey)	$2,000.00
March 3, 1873	50,000.00	July 13, 1892 (allotted from appropriation for Red River)	1,701.33
August 14, 1876	13,000.00	August 18, 1894	10,000.00
June 18, 1878	15,000.00	June 3, 1896	5,000.00
March 3, 1879	6,000.00		
August 5, 1886	18,000.00	Total	145,701.33
August 11, 1888 (allotted from appropriation for Red River)	5,000.00		
September 19, 1890 (for survey)	10,000.00		

COMMERCIAL STATISTICS.

Cypress Bayou between Jefferson and the lakes was reported navigable all the year for light-draft boats. Only during June could a boat ascend from Shreveport, La.

List of boats engaged in the trade during the fiscal year.

Name.	Class.	Tonnage.	Length.	Breadth.	Depth.	Draft.		Between—	Round trips.	Passengers.
						Light.	Loaded.			
			Feet.	*Feet.*	*Feet.*	*Feet.*	*Feet.*			
Anna Tardy	Stern-wheel	71	81.2	18	4	2	3	Jefferson and local points.	.....	....
Nyma May	Gasoline	14	.....	.....	.....	1	1.9	.....do.....	5	176

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Summary of commerce reported.

Articles.	1904–5.
	Tons.
Cotton	70
Cotton seed	280
Grain	5
Miscellaneous	5,544
Total	5,897

Estimated value, $32,320.

V 3.

IMPROVEMENT OF OUACHITA AND BLACK RIVERS, ARKANSAS AND LOUISIANA.

GENERAL IMPROVEMENT.

Snagging operations for the maintenance and general improvement of navigation were not resumed during the year, the snag boat *O. G. Wagner* being unfit for service.

Proper care was taken of the plant laid up at Monroe, La., and after approval of the project for expenditure of the appropriation made by river and harbor act of March 3, 1905, plans for rebuilding the *Wagner* were commenced.

In May, 1905, U. S. quarter boat *No. 3* was towed from Monroe, La., to Camden, Ark., for use during the approaching low-water season of a party, equipped with tools, tackle, explosives, etc., which will work downstream and remove leaning timber, tree slides, etc., and obstructions in the channel. It is proposed also to use the small snag boat *Thos. B. Florence* for the removal of obstructions to navigation below Monroe, La.

COMPLETION OF SURVEY FOR LOCKS AND DAMS.

When not engaged upon other work, the draftsman at this office continued the map sheets, scale 1:10,000 upon heavy drawing paper. At close of the year 42 of the 48 sheets of the main line were completed in ink, except titles and scales.

Gauge readings at Camden, Ark., Riverton, La., and Black River station, opposite Jonesville, La., were continued during the year. The readings at Riverton and Black River were discontinued June 30, 1905.

LOCKS AND DAMS NOS. 4 AND 6.

The work of building these two locks and dams by contract was advertised three times. (See Report Chief of Engineers, 1904, pp. 2039 and 2040.)

The bids invited by the last advertisement, June 18, 1904, were opened August 17, 1904, and but two complete bids were received. The aggregate of the lowest bid—that of the Chicago Engineering and Constructing Company—based upon the estimated quantities of work to be performed, was as follows:

For building Lock and Dam No. 4	$226,873.96
For building Lock and Dam No. 6	201,264.00
Total	428,137.96

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The amount of this bid, added to the estimate for administration, inspection, and contingencies, indicated that the cost of the work would be $40,312 in excess of the amount authorized for completion, due chiefly to the prices for concrete, which were 25 per cent higher at Lock 4 and 33⅓ per cent higher at Lock 6 than were anticipated when the original estimates were prepared in 1902.

Under authority of section 2 of the emergency river and harbor act of April 28, 1904, and with approval of the Secretary of War, a contract was entered into September 7, 1904, with the Chicago Engineering and Constructing Company to build Lock and Dam No. 6 complete, and to build Lock and Dam No. 4, with exception of the following items:

Lock keeper's dwelling	$4,800.00
Maneuvering boat	3,500.00
Winches, four, at $125	500.00
Backfill and embankment, 5,500 cubic yards, at 60 cents	3,300.00
Concrete paving, 3,140 square yards, at $2	6,280.00
Needles, 28,566 feet B. M., at $60 per 1,000 feet	1,713.96
Structural steel (gates and parts of movable dams), 193,000 pounds, at 10½ cents	20,265.00
Total cost, at prices bid, of work omitted from contract	40,358.96

The river and harbor act of March 3, 1905, authorized continuing contracts, to complete the two locks and dams, at a cost not to exceed $40,312, to be paid for as appropriations may be made, and, under this provision, a supplementary contract was entered into April 24, 1905, with the Chicago Engineering and Constructing Company covering the items specified above, at Lock and Dam No. 4, omitted from the original contract.

The contractors commenced construction work October 28, 1904, but a rise of the river caused a suspension of operations at Lock No. 4 December 24, and the work of building a mound for the lock keeper's dwelling at Lock No. 6 was stopped by the same cause January 6, 1905. Continued high stages to June 30 prevented further work of building, but during the interval the contractors were actively engaged in procuring and assembling plant, building quarters, shops, barges, etc., and delivering material, so as to expedite operations during the season of low water.

The work performed and payments made under the contract have been as follows:

Lock and Dam No. 4.

Foundation piles (driven), 6,684 linear feet, at 25 cents	$1,671.00
Foundation piles (delivered, but not driven), 30,000 linear feet, at 10 cents.	3,000.00

Lock and Dam No. 6.

Clearing and grubbing 1.2287 acres, at $200	245.74
Embankment (for mound), 11,674 cubic yards, at 60 cents	7,004.40
Total cost	11,921.14
Ten per cent retained	1,192.11
Amount paid contractors	10,729.03

After careful study a special report was submitted February 3, 1905, recommending certain changes of design of the two locks and dams to

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better meet the conditions at the localities and to more certainly insure the stability of the structures, viz:

(1) To provide aprons for full length of the dams with riprap so disposed as to counteract and limit the scour and to underdrain the dams to prevent excessive upward pressure through leakage from the upper pools.

(2) To place the locations of the locks downstream from the dams so as to lessen the probability of underflow and upward pressure developing under the floors of the lock chambers and walls; to change the method of filling and emptying the locks, and to arch the floor of the lock chambers.

These changes were recommended for approval by the division engineer and were authorized by the Chief of Engineers, if their adoption could be covered by a supplementary contract without increasing the cost of the work.

Modified plans were prepared, and, after determining that they could be adopted without increasing the cost of the work, a proposed form of second supplementary contract with the Chicago Engineering and Constructing Company was submitted, through the division engineer, June 21, 1905. Under date of July 3, 1905, the Chief of Engineers authorized the execution of this supplementary contract, subject to the approval of the Secretary of War.

Reference is invited to the appended report of Mr. T. C. Thomas, assistant engineer.

ESTIMATES.

The amounts expended during the year and the unexpended balances July 1, 1905, were as follows:

Allotment.	Expended during year.	Balance unexpended July 1, 1905.
Maintenance of improvement	$3,813.01	$20,743.25
Dredging at Catahoula shoals		10,000.00
Rebuilding snag boat O. G. Wagner		50,000.00
Completion of survey	1,549.65	608.70
Locks and Dams Nos. 4 and 6	17,006.33	306,973.66
Total	22,368.99	388,325.61

These balances are to be applied to the purposes designated above in the column of allotments.

The following additional amounts can be expended profitably during the fiscal year ending June 30, 1907:

Completing Locks and Dams Nos. 4 and 6, being balance pledged by river and harbor acts of 1902 and 1905, under continuing contract (contract expires December 31, 1906)	$132,266
Maintenance of improvement for one year by snagging work	20,000
Total	152,266

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Money statement.

July 1, 1904, balance unexpended		$318,677.10
Amount appropriated by river and harbor act approved March 3, 1905		80,000.00
Amount appropriated by sundry civil act approved March 3, 1905		12,000.00
Amount received from sales of property		17.50
		410,694.60
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$17,006.33	
For completion of survey	1,549.65	
For maintenance of improvement	3,813.01	
		22,368.99
July 1, 1905, balance unexpended		388,325.61
July 1, 1905, outstanding liabilities		1,219.81
July 1, 1905, balance available		387,105.80
July 1, 1905, amount covered by uncompleted contracts		416,216.82
Amount (estimated) required for completion of existing project		1,696,888.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	132,266.00	
For maintenance of improvement	20,000.00	
		152,266.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

The appropriations have been as follows:

By act of—		By act of—	
March 3, 1871	$25,000	September 19, 1890	$15,000
March 3, 1871	26,000	July 13, 1892	40,000
June 10, 1872	60,000	August 18, 1894	50,000
June 10, 1872	40,000	June 3, 1896	70,000
March 3, 1873	60,000	March 3, 1899	110,000
August 14, 1876	12,000	June 13, 1902	31,500
June 18, 1878	10,000	June 13, 1902	80,000
March 3, 1879	10,000	March 3, 1903	250,000
June 14, 1880	8,000	March 3, 1905 (river and harbor act)	80,000
March 3, 1881	12,000	March 3, 1905 (sundry civil act)	12,000
August 2, 1882	12,000		
July 5, 1884	15,000	Total	1,066,000
August 5, 1886	17,500		
August 11, 1888	20,000		

ABSTRACT OF CONTRACT IN FORCE.

Name of contractor: Chicago Engineering and Constructing Company.
Character of work: Construction of Locks and Dams Nos. 4 and 6, Ouachita River, Louisiana and Arkansas.
Date of original contract: September 7, 1904. Supplementary contract dated April 24, 1905.
Date of approval of original contract: September 26, 1904.
Supplementary contract approved: June 14, 1905.
Date of beginning work: October 28, 1904.
Date contract expires: December 31, 1906.

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Details and prices.

Classification.	Approximate quantities.		Unit prices.	
	No. 4.	No. 6.	No. 4.	No. 6.
Lock keeper's dwellings.....number..	1	1	$4,800.00	$4,800.00
Maneuvering boats.....do....	1	1	3,500.00	3,500.00
Valves for 20-inch pipe.....do....	8	8	200.00	200.00
Winches.....do....	4	4	125.00	125.00
Clearing and grubbing .....acres..	¼	1¼	200.00	200.00
Excavated material .....cubic yards..	16,500	18,000	.75	.75
Portland cement concrete.....do....	14,700	12,800	7.50	8.00
Gravel filling.....do....	1,000	1,000	1.50	1.50
Backfill and embankment .....do....	5,500	7,900	.60	.60
Concrete paving.....square yards..	3,140	1,570	2.00	2.00
Miter sills, posts, etc. (oak).....feet B.M..	6,100	6,100	[a] 50.00	[a] 50.00
Framed timber..... .....do....	16,100	16,100	[a] 30.00	[a] 30.00
Needles.....do....	28,566	20,200	[a] 60.00	[a] 60.00
Sheet piling.....linear feet..	39,500	29,800	.65	.65
Foundation piles (driven) .....do....	59,600	31,400	.25	.30
Drain pipe, 4-inch unglazed tile .....do....	500	500	.20	.20
Cast-iron pipe, 20 inches in diameter.....do....	250	250	6.50	6.50
Structural steel.....pounds..	285,000	250,000	.10½	.10½
Cast iron .....do....	64,900	51,000	.08½	.08½
Bolts, special irons, etc.....do....	9,000	9,000	.08	.08
Sprocket chain .....do....	2,700	2,700	.08	.08
Chain .....do....	2,300	2,000	.08½	.08½
Steel bars (1 inch).....do....	22,400	18,800	.06	.06

[a] Per 1,000 feet B. M.

COMMERCIAL STATISTICS.

During the fiscal year 1905 Ouachita and Black rivers were reported navigable for New Orleans packets to Camden, Ark., from January 1 to June 30. At lowest stages New Orleans boats could not ascend above Harrisonburg, La.

List of boats engaged in the trade during the fiscal year.

Name.	Class.	Tonnage.	Length.	Breadth.	Depth.	Draft.		Between—	Round trips.	Passengers.
						Light.	Loaded.			
			Feet.	*Feet.*	*Feet.*	*Feet.*	*Feet.*			
Little Rufus.....	Stern-wheel.	278	131.0	29.5	5.0	2.0	5.0	Natchez, Miss., and local points.	52	.....
Bob Blanks.....	....do....	265	175.0	35.0	5.0	3.0	7.0	New Orleans and Monroe.	24	2,407
F. Weyerhauser[a]..	....do....	216	140.0	31.0	4.5	3.0	4.5	Jonesville and New Orleans.	1	.....
Columbia[b]	....do....	139	170.0	29.0	4.0	2.0	5.0	Not reported.....	....	.....
Control.....	....do....	103	118.5	27.4	4.6	.....	.....	New Orleans and Camden.	2	.....
Roberta	....do....	94	135.0	26.0	4.0	2.5	6.0	New Orleans and local points.	17	435
Vernie Swain.....	....do....	94	.....	.....	.....	1.2	5.0	Natchez, Miss., and local points.	70	.....
Frank B. Hayne...	....do....	90	130.4	27.0	4.0	2.0	5.0	New Orleans and Camden.	1	7
								New Orleans and Harrisonburg.	5	48
J. W. Swayze	....do....	86	110.0	21.0	3.7	2.4	4.0	Jonesville and local points.	48	75
H. C. Brockman[a]..	....do....	75	91.0	22.6	3.8	2.0	3.0	Jonesville and New Orleans.	1	0
Ike	....do....	66	57.7	18.2	2.6	1.9	1.9	Camden and mouth of Little Missouri.	....	.....
Lillie[a]	....do....	61	120.0	26.0	3.5	2.0	4.0	Torras and local points.	....	.....
May Fisher.....	....do....	52	92.0	18.8	4.0	2.0	2.0	Natchez and mouth of Saline River.	1	.....
Handy	....do....	49	110.0	22.0	3.0	2.0	5.0	Monroe and local points.	22	276
Welcome	.....	9	.....	.....	.....	1.0	2.0	Monroe and Ouachita City.	81	.....
Dixieland	Gasoline.	.....	.....	.....	.....	2.1	2.9	Monroe and local points.	22	103
Wamba.....	.....	.....	.....	.....	.....	3.5	4.0	Not reported.....	....	.....

[a] Towboat. [b] Destroyed by fire at New Orleans Feb. 3.

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Summary of commerce reported.

Articles.	1904–5.	Articles.	1904–5.
	Tons.		*Tons.*
Cotton	11,695	Provisions	2,482
Cotton seed	9,349	Grain	4,906
Live stock	536	Miscellaneous	5,331
Lumber	3,200		
Saw logs	93,596	Total	141,779
Staves	10,734		

Estimated value, $3,243,200.

The following letters were received in response to a circular request made April 24, 1905, for reliable information of the effect of the project upon freight rates, especially upon the following points, viz:

(1) The comparative rates by water and by rail upon staple commodities usually shipped by steamboats, such as cotton, cotton seed and its products, staves, lumber, live stock, provisions, etc.

(2) The rates by rail for the same classes of freight shipped from and to inland towns some distance away from the river.

(3) Whether railroad rates are increased when navigation is suspended; and, if so, a comparative statement showing the increase at such times.

MONROE PROGRESSIVE LEAGUE,
Monroe, La., April 28, 1905.

Capt. G. M. HOFFMAN,
Corps of Engineers.

MY DEAR SIR: Referring to your favor of April 24, we beg to hand you herewith a statement showing the rate situation to competitive points on the Ouachita River with the rail lines, and also to noncompetitive points about the same distance on the rail lines.

The territory in northern Ouachita waters has only recently been opened to railway traffic, and the rail lines as yet have not met the water rates. They will no doubt do so at an early date.

We would call your special attention to rate on cotton from Monroe to New Orleans during navigation; also the rate when navigation closes, in the Ouachita River. You will note that there is a difference of 50 cents per bale.

We have compiled these statements showing a few of the leading commodities.

We would suggest that you write Mr. M. E. Fahy, No. 620 Commercial place, New Orleans, La., and ask him to send you a statement showing the rates applying by boats and rail from New Orleans to Camden, Ark. This will make a very fine showing for the necessity of keeping the Ouachita River open all the year round for navigation.

We are satisfied that there is not a man in the Ouachita Valley but what fully appreciates the necessity of the placing of locks and dams in the Ouachita River so that it will be open to navigation all the year round; and there is no question about a matter of this kind having a direct effect upon the rates, especially to competitive territory.

We find that it is a hard matter to compare railroad rates with steamboat rates, for the reason that they are compiled entirely different, one being made up on the per hundredweight basis and the other being made up almost entirely so much per package. However, the figures that we have given you in the inclosed statements are absolutely correct, and can be verified by referring to the tariffs on file in the offices of the different rail and boat lines.

We believe that these figures will cover the situation in the territory around Monroe and show the conditions absolutely impartial.

If you desire any further information, or if, in your opinion, these statistics can be compiled in better form, we shall be pleased for you to advise us, and we will try and make up such statements as you desire, or which, in your opinion, will have the best effect, as we are very anxious to see the good work go forward as rapidly as possible in the Ouachita River, so that it will be but a few years before we will have navigation the year round.

With kindest regards we remain,
Yours truly,

H. D. APGAR,
Secretary Monroe Progressive League.

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Comparison of freight rates.

Articles.	Boat lines. Monroe to Columbia, La. Tariff, Parker Line, no number. Distance by river, 75 miles.	St. Louis, Iron Mountain and Southern Railway. Monroe to Columbia, La. Tariff, 4523. Distance by rail, 29 miles.
	Rate per cwt.	*Rate per cwt.*
Tinware	$0.25	$0.27
Coal oil	.17	.20
Dry goods	.25	.27
Bacon	.10	.10
Flour	.10	.10
Meal	.10	.10
Grain	.10	.10
Groceries	.26	.27
Salt	.10	.10
Canned goods	.10	.13
Lumber	.12½	.06
Sugar and molasses	.10	.10
Rice	.10	.10
Fertilizer	.12½	.15
Apples and vegetables	.10	.10
Agricultural implements	.20	.20
RATES TO MONROE.		
Cotton, per bale	.50	.65
Cotton seed, per hundredweight	.10	.05½

Above rates made by boats, and rail line met the competition.

[No water competition.]

Articles.	Vicksburg, Shreveport and Pacific Railway. Monroe to Sibley, La. Distance, 69 miles. Tariff, 502-A.	St. Louis, Iron Mountain and Southern Railway. Monroe to Georgetown, La. Distance, 61 miles. Tariff, 4523.
	Rate per cwt.	*Rate per cwt.*
Tinware	$0.43	$0.45
Coal oil	.32	.33
Dry goods	.45	.45
Bacon	.15	.22
Flour	.15	.22
Meal	.15	.22
Grain	.15	.22
Groceries	.43	.45
Salt	.15	.22
Canned goods	.20	.28
Lumber	.12	.07
Sugar and molasses	.19	.22
Rice	.19	.22
Fertilizer	.25	.28
Apples and vegetables	.19	.23
Agricultural implements	.43	.30
RATES TO MONROE.		
Cotton, per bale	2.00	1.75
Cotton seed	.10	.07½

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Comparison of freight rates—Continued.

[Monroe to Farmerville, La.]

Articles.	Rate per hundredweight.		Articles.	Rate per hundredweight.	
	Boat lines.[a]	Rail.[b]		Boat lines.[a]	Rail.[b]
Tinware	$0.25	$0.50	Lumber	$0.10	$0.12
Coal oil	.25	.42	Sugar and molasses	.15	.20
Dry goods	.40	.50	Rice	.20	.20
Bacon	.20	.20	Fertilizer	.10	.21
Flour	.15	.19	Apples and vegetables	.15	.25
Meal	.15	.19	Agricultural implements	.25	.37
Grain	.15	.20	Cotton into Monroe:		
Groceries	.25	.50	Cotton seed	.10	.10
Salt	.10	.12	Cotton (per bale)	.75	1.50
Canned goods	.15	.20			

[a] Tariff 912, Sup. No. 2, Monroe Ry. and Navigation Co. Distance by boat to Monroe, 69 miles.
[b] St. Louis, Iron Mountain and Southern Ry. Tariff 5226–B. Distance by rail from Monroe, 83 miles.
About the same rates apply to all points north on the Ouachita River, and these figures conservatively cover the situation.

The rail line in operation to Farmerville only a few months, and they have never met the water competition.

Rate on cotton per bale, Monroe to New Orleans: During navigation, $1.25; when navigation closes, $1.75.

[Monroe, La., to all points north of State line, to and including Camden, Ark. Distance from Monroe, 85 to 250 miles. Monroe Railway and Navigation Co. Tariff No. 912, Supplement No. 2. No direct rail competition.]

Articles.	Per hundredweight.	Articles.	Per hundredweight.
Tinware	$0.25	Flour	$0.15
Coal oil, per barrel	1.00	Meal	.15
Dry goods	.40	Grain	.15
Cotton piece goods	.25	Groceries	.25
Smoking tobacco	.50	Salt	.10
Plug tobacco	.50	Canned goods, under 20 pounds, per case	.10
Furniture, 1,000 pounds and over	.25	Canned goods, over 20 pounds, per case	.15
Bacon	.20		

Cotton into Monroe from above points, per bale	$0.65
Cotton seed into Monroe from above points, per hundredweight	.10

NEW ORLEANS, LA., *May 6, 1905.*

Captain HOFFMAN:

DEAR SIR: Below is all the information I have at present as to differences in rail and water rates on main commodities to Arkansas points, referred to in yours of May 1.

If you are not in a hurry would suggest your writing Mr. A. Felsenthal, Camden, for information as to whether rail rates are higher during suspension of navigation, or not.

Yours, truly, M. E. FAHY.

Rates from New Orleans during high-water season, in cents, per 100 pounds.

	To Lapile, Ark., and other stations near Ouachita River in Arkansas.		To Camden, Ark.	
	Rail.	River.	Rail.	River.
Rice, sugar, molasses	$0.44	$0.25	$0.25	$0.25
Coffee	.61	.30	.40	.30
Dry goods, boots and shoes	1.04	.70	1.10	.70
Cotton to New Orleans, per bale	2.75	1.25	2.75	1.25

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REPORT OF MR. H. M. MARSHALL, ASSISTANT ENGINEER.

MONROE, LA., *June 30, 1905.*

CAPTAIN: I have the honor to submit the following report on general improvement of Ouachita and Black rivers, Arkansas and Louisiana, for the fiscal year ending June 30, 1905:

MAINTENANCE.

At the beginning of the fiscal year the condition of the U. S. snag boat *O. G. Wagner*, which annually for several years had been reported as very bad, had reached the point where she was entirely unfitted for operations on the river. The funds on hand were insufficient to make repairs, if any could have been done profitably; therefore she was laid up at Monroe, La., and cared for only to the extent necessary to preserve the outfit, tools, and tackle, some of which is yet of value. A new canvas was put on the roof and painted to stop the leaking.

The U. S. launch *Ouachita* was cared for at Monroe, La., also, and was used making inspections and in towing the chopping party from Stafford Point to Monroe in February, and thence to Camden, Ark., May 17 to 31.

During the latter part of March the river from Monroe to about 25 miles above Camden was inspected by the district officer, and in January that part between Monroe and Trinity, La., was inspected by me. The river was found to be in very good condition, almost no snags or obstructions showing. While the river was considerably above the low-water stage, it was about the height at which there is most traffic.

Plans for a new steel-hull snag boat to take the place of the *Wagner* are well underway, and the boat probably will be built by next season.

Gauges were read at Riverton and Black River station, La., and Camden, Ark., during the year. The gauge at Camden was rebuilt during September, 1904, and was moved upstream 1.4 miles to the bridge of the St. Louis Southwestern Railway Company. The gauge is bolted to the casing of the pivot pier, and the zero is the same elevation as the old gauge, viz, 71.17 feet above Gulf level.

The highest and lowest stages reached were as follows:

Station.	Highest reading.		Lowest reading.		Range (feet).
	Date.	Feet.	Date.	Feet.	
	1905.		1904.		
Camden, Ark	May 9	41.6	Oct. 28–Nov. 2	3.1	31.5
Riverton, La	June 3	48.6	Nov. 19, 20	.9	47.7
Black River station, La	June 23	45.35	Dec. 22–24	5.11	40.24

SURVEY.

December 27, 1904, at 10.30 p. m., during a hard rain and rapid rise of the river the catamaran used to make borings sank. It was pulled out on the bank two days later and wrecked. The machinery and tools were removed with almost no loss and stored on the U. S. snag boat *Wagner*.

Work on the maps on heavy drawing paper was continued in the Vicksburg engineer office by Mr. John Hilleke, and the sheets were finished in ink, except title, legend, and scale, to No. 43, and were plotted in pencil complete to No. 48.

Very respectfully, your obedient servant,

H. M. MARSHALL,
Assistant Engineer.

Capt. G. M. HOFFMAN,
Corps of Engineers.

REPORT OF MR. T. C. THOMAS, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Vicksburg, Miss., July 1, 1905.

CAPTAIN: I have the honor to report on the work of improving the Ouachita River, Arkansas and Louisiana, by locks and dams, for the fiscal year ending June 30, 1905.

I was placed in local charge of this work on April 1, succeeding Assistant Engineer H. M. Marshall, transferred to other work.

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During the early part of the year a project for the construction of Locks and Dams Nos. 4 and 6 by force account was prepared; with the view of prosecuting the work by that method should the bids submitted at the August letting prove unsatisfactory. An estimate of cost of plant, etc., was made from information obtained by personal visit to dealers and manufacturers. August 17 the contract for the locks and dams named above was awarded to the Chicago Engineering and Constructing Company, with the exception of the lock keeper's house, maneuvering boat, and other minor features for Lock No. 4; these items being omitted because the prices named in the accepted proposal indicated that the total cost of the work under those prices would exceed the amount authorized by Congress. Contract was entered into on September 7, and on April 24 the contractors signed a supplementary agreement which covered the items excepted in the contract of September 7, funds to cover the cost of these items having been provided by act of Congress approved March 3, 1905.

The contractors began building laborers' quarters at site of Lock No. 4 in October. During November a pile-driver barge was built and launched, and a steam hammer outfit was installed early in December. They began driving piles on December 10, and continued until the 23d, when this work was suspended on account of a rise in the river; 194 piles were driven in the floor foundation of Lock 4, from the upper miter wall downstream for the greater part of the length of the lock chamber, aggregating 6,684 linear feet of piling in place below grade.

The river stage has continued too high for construction work inside the main banks, and operations have been confined largely to construction of barges, shop buildings, etc., and the installation of machinery. In February the lock site was connected with the St. Louis, Iron Mountain and Southern Railroad by a spur track 1,800 feet long.

During April a 1-yard orange-peel bucket with derrick hoisting engine and boiler was installed on a 30 by 80 foot barge for dredging gravel, and the steamer *City of Wheeling*, together with seven decked barges, was chartered at Greenville, Miss., and brought to the lock site.

The contractors began dredging gravel from a bar at Ouachita City, La., about 27 miles above and transporting same to the lock site on May 1. Dredging was continued until May 23, when about 4,500 cubic yards of gravel had been obtained and stored at the lock site. This work was then discontinued on account of the high river stage and the swift current, and the *City of Wheeling* with six barges was returned to her owners. In June a small towboat, the *F. A. Goebel*, was purchased by the contractors, but dredging has not been resumed on account of the continued high water. The floating plant now at Lock No. 4 consists of one orange-peel dredge, already referred to; one hydraulic dredge with 8-inch centrifugal pump and revolving screen on a 24 by 50 foot barge; eight decked barges, varying from 16 by 60 feet to 24 by 130 feet; one towboat, 22 by 110 feet, with 10-inch by 4-foot engines. The buildings constructed are: Office, 20 by 30 feet; mill shed, 24 by 60 feet; boiler house, 30 by 40 feet; blacksmith shop, 16 by 24 feet; tool house, 16 by 30 feet; warehouse, 16 by 40 feet; foremen's quarters, 25 by 40 feet; laborers' quarters, 24 by 65 feet; dining room, 24 by 65 feet; kitchen 16 by 24 feet; commissary, 16 by 36 feet; lumber shed, 30 by 60 feet. Pile foundations have also been driven for cement house and mixer platform; a 15,000-gallon wooden tank built, and water pipes laid to the principal buildings.

The following plant is installed: One 60-horsepower boiler, one air compressor, one 30-kilowatt dynamo, one 25-horsepower engine for air compressor and dynamo, one swinging saw, one pneumatic boring machine, one pneumatic bolt driver, and four 10-ton traveling stiff-leg derricks with hoisting engines. Other plant and machinery on the ground embraces: One 50-horsepower boiler, three stationary engines, one 5 by 6 inch Worthington duplex pump, three 8-inch centrifugals, direct connected to engines; three 2,500-pound drop hammers, 2,500 feet of tram track; 25 dump cars, 1½ and 3 yard capacities; blacksmith and miscellaneous small tools.

The material on the ground comprises 36,000 linear feet of piling, 250,000 board feet of lumber, and 4,500 cubic yards of gravel.

In October the contractors began clearing and grubbing the site for a mound at Lock No. 6. The mound is intended to support the lock keeper's dwelling, the land adjacent to this lock being overflowed frequently and to considerable depths. On December 9 a small team and scraper force began building the mound, the work being prosecuted until January 5, when it was discontinued on account of high water, after placing 11,674 cubic yards, about half the intended fill.

There were no further operations at this lock, as the river remained high until the end of the fiscal year.

In February Capt. Geo. M. Hoffman, engineer officer in charge, recommended to the Chief of Engineers certain modifications in the plans for Locks and Dams Nos. 4

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and 6, to better meet existing conditions of foundation beds and to insure more certainly the stability of the structures. The proposed changes were approved on condition that the total cost of the work should not be increased thereby.

The modifications consist broadly in the addition of a concrete apron along the downstream side of the dam to receive the overfall and deliver it in a direction inclined slightly upward; the placing of riprap beneath the back part of dam, and the substitution of round piling with 2-inch clearance between piles for the triple lap sheet piling called for by the old plans under the downstream edge of the dam—this to allow free drainage from beneath the dam and apron into the lower pool. The dam is moved up opposite the upper lock gates from the middle of the lock; the method of filling and emptying the lock chamber is modified, and the lock floor is changed to a flat arch.

New drawings have been made in accordance with these modifications, the work containing a total of twenty-nine sheets, divided as follows: Eight applying specially to Lock and Dam No. 4; 9 specially to No. 6, and 12 common to both, or common with certain exceptions noted on the sheets.

Estimates were prepared for the modified plans and former estimates revised.

Junior Engineer L. E. Lion and Inspector John W. Henderson joined the work in November. Since the cessation of active field work they have been employed at the Vicksburg office generally, drawing, computing, and making tests of cement and of the gravel (sand and pebbles) proposed for use at Lock and Dam No. 4.

Statement of cost of work for fiscal year ending June 30, 1905.

6,684 linear feet of piling (driven), at 25 cents	$1,671.00
30,000 linear feet of piling (delivered), at 10 cents	3,000.00
1.2287 acres cleared and grubbed, at $200	245.74
11,674 cubic yards embankment in mound, at 60 cents	7,004.40
Engineering and superintendence:	
Services, field	4,328.58
Services, office, clerical	1,245.50
Subsistence	32.75
Travel expenses	117.66
Instruments and engineering supplies	390.18
Miscellaneous	152.88
Total	18,188.69

Very respectfully, your obedient servant,

T. C. THOMAS,
Assistant Engineer.

Capt. G. M. HOFFMAN,
Corps of Engineers.

V 4.

IMPROVEMENT OF BAYOU BARTHOLOMEW, BOEUF RIVER, TENSAS RIVER, AND BAYOU MAÇON, AND BAYOUS D'ARBONNE AND CORNEY, LOUISIANA.

A statement of the scope of work for maintenance of navigation of these tributaries of Ouachita River was given in the last report. (Report Chief of Engineers, 1904, p. 2043.)

Operations during the fiscal year ending June 30, 1905, were as follows:

BAYOU BARTHOLOMEW.

Work in progress June 30, 1904, near Gordon Bluff, La., under Overseer J. R. Vaughan, was continued until August 23, 1904; was carried upstream to the Louisiana-Arkansas line and thence back to the mouth, putting that stretch of 85.7 miles in good navigable condition for the time.

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The following is a summary of the work performed:

Channel snags cut and destroyed	858
Shore snags cut and destroyed	212
Logs cut and destroyed	1,141
Logs removed from channel	235
Stumps cut and destroyed	102
Side jams broken up and destroyed	7
Trees removed from channel	121
Leaning trees felled and destroyed	371
Square yards of willows and brush cut	6,355

BAYOUS D'ARBONNE AND CORNEY.

After completing work in Bayou Bartholomew, the party was transferred to Bayou D'Arbonne. The quarter boat was moved to Cross Bayou, 5 miles above the mouth, as far upstream as the stage permitted, and from that point tools, supplies, etc., were hauled by wagon to Ford Landing, 12.4 miles above the mouth. From that point the party worked downstream to the mouth, thoroughly clearing "The Points," which constitute the chief obstruction to navigation, so as to permit the passage of boats at high stages. This work was completed August 31, 1904, the following obstructions having been removed:

Channel snags cut	206
Shore snags cut	69
Logs cut up	160
Stumps cut up	48
Leaning trees felled and cut up	66
Square yards of willows and brush cut	6,484

BOEUF RIVER.

August 31, 1904, the quarter boat was moved down Ouachita River from the mouth of Bayou D'Arbonne to Monroe, La., where it remained until September 7 receiving supplies and explosives. On the latter date the boat continued down Ouachita River and reached the mouth of Boeuf River September 11. Work commenced September 12, but was suspended September 21, as a rapid decline of the river rendered it impracticable for the quarter boat to cross the bars and continue up Boeuf River. About 9 miles of river were worked over, and the following obstructions to navigation were destroyed, viz:

Channel snags cut and destroyed	90
Shore snags cut and destroyed	25
Logs removed from channel	19
Logs cut up and destroyed	31
Stumps cut and destroyed	15
Leaning trees felled and destroyed	13

The working force was laid off September 21, 1904, and the quarter boat placed in charge of a watchman. Early in February, 1905, the boat was towed to Monroe, La., to undergo repairs.

TENSAS RIVER AND BAYOU MACON.

No work was done in these streams during the year.

The latter part of June, 1905, the construction of two light quarter boats was commenced at Delhi and Oak Ridge, La., preparatory to resuming work for the removal of obstructions to navigation of Bayou Maçon and Boeuf River in July.

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Money statement.

	Bayou Bartholomew.	Boeuf River.	Tensas River and Bayou Maçon.	Bayous D'Arbonne and Corney.	Total.
July 1, 1904, balance unexpended	$1,350.51	$6,124.37	$1,123.07	$563.58	$9,161.53
Amount appropriated by river and harbor act approved Mar. 3, 1905 [a]	5,000.00	5,000.00	5,000.00	2,000.00	17,000.00
	6,350.51	11,124.37	6,128.07	2,563.58	26,161.53
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	1,350.51	1,892.83	341.60	127.16	3,212.10
July 1, 1905, balance unexpended	5,000.00	9,781.54	5,781.47	2,436.42	22,949.43
July 1, 1905, outstanding liabilities	.....	872.80	96.91	.....	469.71
July 1, 1905, balance available	5,000.00	9,358.74	5,684.56	2,436.42	22,479.72

[a] Allotments approved by Secretary of War April 7, 1905.

The appropriation of March 3, 1905, having been for two years' work, no estimate is made for the fiscal year ending June 30, 1907.

The appropriations for the improvement of these streams have been as follows:

By act of—	Bayou Bartholomew.	Boeuf River.	Tensas River and Bayou Maçon.	Bayous D'Arbonne and Corney.	Total.
March 3, 1881	$8,000.00	$5,000.00	$3,000.00	.....	$16,000.00
August 2, 1882	5,000.00	5,000.00	.....	.....	10,000.00
July 5, 1884	5,000.00	5,000.00	4,000.00	$5,000.00	19,000.00
August 5, 1886	5,000.00	5,000.00	4,000.00	2,000.00	16,000.00
August 11, 1888	5,000.00	6,000.00	5,000.00	2,000.00	18,000.00
September 19, 1890	5,000.00	5,000.00	5,000.00	2,000.00	17,000.00
July 13, 1892	5,000.00	10,000.00	5,000.00	4,000.00	24,000.00
August 18, 1894	5,000.00	8,000.00	5,000.00	[a] 2,000.00	20,000.00
June 3, 1896	4,000.00	6,000.00	5,000.00	.....	15,000.00
March 3, 1899	5,000.00	6,000.00	4,000.00	.....	15,000.00
June 13, 1902 (allotments)	5,000.00	3,500.00	4,000.00	2,500.00	15,000.00
March 3, 1905 (allotments)	5,000.00	5,000.00	5,000.00	2,000.00	17,000.00
Total amount appropriated	62,000.00	69,500.00	49,000.00	21,500.00	202,000.00
Total amount expended	57,000.00	59,768.46	43,218.53	19,063.58	179,050.57
Balance unexpended	5,000.00	9,731.54	5,781.47	2,436.42	22,949.43

[a] Act of August 18, 1894, also appropriated $1,000 for Little D'Arbonne.

It is proposed to apply the available balances to a continuance of the work for maintenance of navigation.

The work was under the local supervision of Mr. H. M. Marshall, assistant engineer, whose report is appended hereto.

COMMERCIAL STATISTICS.

BAYOU BARTHOLOMEW.

During the fiscal year 1905 Bayou Bartholomew was reported navigable from January to June, inclusive.

List of boats engaged in the trade during the fiscal year.

Name.	Class.	Tonnage.	Length.	Breadth.	Depth.	Draft.		Between—	Round trips.
						Light.	Loaded.		
			Feet.	*Feet.*	*Feet.*	*Feet.*	*Feet.*		
Handy	Stern-wheel	49	110	22	3	2	5	Monroe and local points	19
Welcome [a]	.....	9	.....	.....	.....	1	2	.....do	.....

[a] With barge.

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Summary of commerce reported.

Articles.	1904–5.	Articles.	1904–5.
	Tons.		*Tons.*
Cotton	687	Grain	375
Cotton seed	500	Miscellaneous	350
Lumber	20		
Provisions	75	Total	2,007

Estimated value, $143,400.

BOEUF RIVER.

During the fiscal year 1905 Boeuf River was reported navigable from January to June, inclusive.

List of boats engaged in the trade during the fiscal year.

Name.	Class.	Tonnage.	Length.	Breadth.	Depth.	Draft.		Between—	Round trips.	Passengers.
						Light.	Loaded.			
			Feet.	*Feet.*	*Feet.*	*Feet.*	*Feet.*			
Roberta	Stern-wheel	94	135.0	26.0	4.0	2.5	2.6	Monroe and Bluff Gin.	2	8
Frank B. Hayne	do	90	130.4	27.0	4.0	2.0	5.0	do	12	31

Summary of commerce reported.

Articles.	1904–5.	Articles.	1904–5.
	Tons.		*Tons.*
Cotton	672	Grain	262
Cotton seed	2,040	Miscellaneous	367
Live stock	17		
Lumber	100	Total	3,578
Provisions	120		

Estimated value, $152,800.

TENSAS RIVER AND BAYOU MAÇON.

During the fiscal year Tensas River and Bayou Maçon were reported navigable from December to June, inclusive.

List of boats engaged in the trade during the fiscal year.

Name.	Class.	Tonnage.	Length.	Breadth.	Depth.	Draft.		Between—	Round trips.	Passengers.
						Light.	Loaded.			
			Feet.	*Feet.*	*Feet.*	*Feet.*	*Feet.*			
Vernie Swain	Stern-wheel	94	.....	.....	.....	1.2	5.0	Natchez, Miss., and local points.	....	....
J. W. Swayze	do	86	110.0	21.0	3.7	2.0	4.0	New Light and Jonesville.	35	175
Lillie	do	61	120.0	26.0	3.5	2.0	4.0	Warsaw and Jonesville	7	....
T. K. Green	do	32	81.8	17.3	3.1	2.0	3.5	New Light and Jonesville.	....	100
Bettie Lee	do	28	56.0	12.0	2.5	1.0	2.5	Lanes Ferry and local points.	28	....
Palmer	Gasoline	14	61.0	14.0	2.5	1.3	2.5	do	32	....

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Summary of commerce reported.

Articles.	1904–5.	Articles.	1904–5.
	Tons.		*Tons.*
Cotton	2,488	Provisions	1,546
Cotton seed	5,713	Grain	1,421
Live stock	27	Miscellaneous	570
Lumber	1,325		
Staves	167	Total	29,957
Saw logs	16,700		

Estimated value, $781,000.

BAYOUS D'ARBONNE AND CORNEY.

During the fiscal year 1905 Bayous D'Arbonne and Corney were reported navigable from January to June, inclusive.

List of boats engaged in the trade during the fiscal year.

Name.	Class.	Tonnage.	Length.	Breadth.	Depth.	Draft.		Between—	Round trips.	Passengers.
						Light.	Loaded.			
			Feet.	*Feet.*	*Feet.*	*Feet.*	*Feet.*			
Handy	Stern-wheel	49	110	22.0	3.0	2.0	5.0	Monroe and Farmerville.	2	13
West Monroe		12				1.0	2.0	do	26	
L. B. Carter	Gasoline	8	54	10.0	2.5	1.0	2.0	Monroe and Moseleys Bluff.	52	
Ada B	do	4	40	8.0	2.5	1.3	2.3	Monroe and mouth of Choudrant.	15	90
Dixieland						1.1	2.9	Monroe and local points.	8	96

Summary of commerce reported.

Articles.	1904–5.	Articles.	1904–5.
	Tons.		*Tons.*
Cotton	461	Grain	112
Cotton seed	123	Miscellaneous	372
Lumber	13		
Saw logs	675	Total	1,989
Provisions	233		

Estimated value, $120,000.

REPORT OF MR. H. M. MARSHALL, ASSISTANT ENGINEER.

MONROE, LA., *June 30, 1905.*

CAPTAIN: I have the honor to submit the following report on improvement of Bayou Bartholomew, Boeuf River, Tensas River, and Bayou Maçon, and bayous D'Arbonne and Corney, Louisiana and Arkansas, for the fiscal year ending June 30, 1905:

BAYOU BARTHOLOMEW.

At the beginning of the fiscal year the chopping party on the quarter boat under Overseer J. R. Vaughan had reached Gordon Bluff, 36.8 miles above the mouth. July 3, 1904, a heavy rain caused a rise, and boat was moved up to State Line, 85.7 miles above the mouth. July 11 the party began working downstream, and reached the mouth August 23. Numerous obstructions were removed from the channel, especially tops of trees thrown into the stream by sawmill men and trees which had fallen in from natural causes.

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D'ARBONNE AND CORNEY.

The party moved down from mouth of Bayou Bartholomew to the mouth of Bayou D'Arbonne, and went up that stream about 5 miles with the quarter boat. Low stage of water prevented their going farther up. They worked up to Ford, 12.4 miles above the mouth, and cleared the "points." Work began August 24 and was finished August 27, 1904.

BOEUF RIVER.

The party, after finishing on D'Arbonne, moved to Monroe, where there was a delay in receiving dynamite. On September 7 the quarter boat started floating down to mouth of Boeuf River, where it arrived September 10, it having been towed the last 25 miles by a commercial boat. The stage of water was so low the boat could not get up Boeuf River, and after working about 2 miles above the mouth the boat was laid up September 21 at Stafford Point, where it remained until January 31, 1905, when it was towed by the U. S. launch *Ouachita* to Monroe, La., arriving there February 3, 1905.

June 9, 1905, Overseer J. W. Baxter was sent to Point Jefferson, Louisiana, 150.8 miles above the mouth, to build a small quarter boat for a chopping party to live on while working down the river. Lumber and materials were shipped to Oakridge, the nearest railroad point to the river, and hauled 6 miles out to Point Jefferson. At this date the boat is nearly ready to be launched.

TENSAS RIVER AND BAYOU MAÇON.

No operations were carried on for the removal of obstructions in Tensas River and Bayou Maçon, but on June 14, 1905, Overseer J. N. Ferguson was sent to Delhi, which is on the Vicksburg, Shreveport and Pacific Railway and 87.5 miles above the mouth of Bayou Maçon, to build a small quarter boat for a chopping party to work downstream. Lumber and materials were shipped to that point and the boat was about half finished at the end of the fiscal year.

Very respectfully, your obedient servant,

H. M. MARSHALL,
Assistant Engineer.

Capt. G. M. HOFFMAN,
Corps of Engineers.

V 5.

IMPROVEMENT OF MOUTH OF YAZOO RIVER AND HARBOR AT VICKSBURG, MISSISSIPPI.

Work, under contract with Helgason Bros. & Garbish, upon the levee extending from mouth of the canal at Kleinston Landing westward across the accretion to De Soto Island and up the West Pass bar (which separates the west arm of Lake Centennial from the Mississippi River) to within about 4,500 feet of King Point, was in progress June 30, and was completed September 30, 1904, two months ahead of the time limit of the contract.

The contents and cost of this levee were as follows:

Section.	Contents.	Price per cubic yard.	Cost.
	Cubic yards.	*Cents.*	
1 (at west end)	106,371	25.0	$26,592.75
2 (intermediate)	109,107	31.5	34,368.71
3 (intermediate)	112,305	[a] 33.9+	38,103.20
4 (at east end)	101,834	32.5	33,096.05
Total	429,677	[b] 30.75+	132,160.71
Additional amount paid under supplementary contract of June 28, 1904 (see Report Chief of Engineers, 1904, p. 2052)			4,500.00
Total cost			136,660.71

[a] Average price; work done by hire of teams, scrapers, etc. [b] Average.

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Payments amounting to $99,331.01 were made to the contractors prior to July 1, 1904. The balance of $37,329.70 was paid during the fiscal year.

The following work was performed by hired labor during the year:

The curved bulkhead and foot mat at west end and the mattress and dike at east end, built in 1903 as temporary protections during high water of the then partly completed levee (see Report Chief of Engineers, 1904, p. 2052), were removed and permanent protections were constructed at both ends of the completed levee. At the west end a rock pavement, consisting of a layer about 10 inches thick of riprap and spalls, was built on the sloping end, thence back 100 feet on the land-side and about 250 feet on the river-side slope, together with a pavement 60 feet wide on the natural ground surface at foot of and laid continuously with that on the levee slopes. The greater part of the rock for this work (1,816 tons) had to be hauled about 1,200 feet from the river bank, and the remainder (254 tons) had to be hauled from the temporary protection, about 3,700 feet. The permanent protection built at the east end consisted of rock paving on the levee slope, beginning 100 feet back from the end of the levee on the lake side and extending around the sloping end of the embankment and thence along the river side for a distance of 555 feet from the end. The ground surface adjacent was protected by a mattress 80 feet wide, built continuously with the paving. On the river side the new work joined a portion of the temporary work built in 1903, extending the protection a farther distance of 80 feet. The paving consisted of a 10-inch layer of riprap, chinked with spalls, except around the sloping end where a 3-inch layer of spalls was covered with about 8 inches of riprap. The mattress work consisted of an upper and lower pole grillage with two layers of willow brush between, the two grillages being connected with wires passing through the brush. The mattress was ballasted with 1½ tons of riprap to the square (10 by 10 feet.) To prevent a concentrated flow in the borrow pit on the river side adjacent to the levee, the pit was crossed by a series of pile and brush dikes with crests level with the natural ground surface bordering the pit. The dikes were anchored to planks buried to a depth of 2½ feet and resting on crossheads nailed to the piles. Scour beneath the brush filling of the dikes was prevented by ballasted foot mats, except for one dike where the brush filling was sunk 1 foot in the ground. The permanent protection at the west end of the levee was completed in September, 1904, and that at the east end was finished in December, 1904.

The bulkhead protection work on the river side of the levee was extended from the end of the levee, as built in 1903, upstream for a distance of 336 feet, protecting from wave wash that portion of the levee extension built in 1904 which has no timber growth along its front.

The latter part of December, 1904, the west half of the levee was inclosed by a barbed-wire fence, to prevent depredations of stock, beginning at low water in the west arm of Lake Centennial and ending on the Mississippi River bar 1,100 feet from the main bank, at west end of the levee.

At intervals during the year a small force was employed at the levee removing drift from the terraces, resurfacing and sodding the slopes, battening and painting the bulkheads, etc.

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Bank slides occurred in the main cut in September, October, and November, 1904, the first on the right bank near the west end of Barnett Lake, followed by a second on the left bank about 300 feet below, and by a third at an intermediate point. The combined sloughing caused a short stretch of narrow and tortuous channel, and November 29 the middle slip was removed with dynamite, widening the channel about 10 feet, and the sliding banks were cleared of timber and brush. Further slides occurred December 12 near the east end of Barnett Lake, where the banks came in practically at opposite points, contracting the channel width to about 40 feet. The points were blasted December 12–13, widening the channel to about 60 feet.

December 15 the point of the gravel bar at mouth of Glass Bayou (Vicksburg Harbor) was removed with explosives, increasing the water width at that locality about 12 feet.

The combination of a flood out of Yazoo River with Mississippi River at a low stage occurred the latter part of December for the first time since the opening of the diversion route, and the swift current, due to the abnormally steep slopes, in January and February caused much caving in the main cut and along the front of Vicksburg, and also a heavy scour and a marked deepening of the dredged channel through the greater part of the canal, the principal exception being at the point of debouchment of the main cut into Lake Centennial, where a channel fill occurred.

October 24 to November 14 a low water survey of the canal was made; November 15–22 a resurvey was made of the left bank of Mississippi River above mouth of the canal to King Point; November 23–30 a survey of the former outlet of Yazoo River was made; March 8 to 18 a survey was made from Old River to Kleinston, to determine changes caused by the abnormal conditions during January and February; and in April a survey was made of the northwestern part of Lake Centennial, to ascertain the fill at and near the mouth of the main cut beyond the limits of the dredged channel. Observations of slope gauges were continued during the year, and longitudinal soundings from Old River to Kleinston were made at intervals. Discharge measurements in Vicksburg Harbor were made December 16 and 31 and February 15 and 16.

Copies of the "Rules and regulations for the control of the Yazoo River Diversion Canal near Vicksburg, Miss.," approved by Acting Secretary of War December 20, 1904 (appended hereto), were posted at conspicuous places along the canal and on the right of way at West Pass levee January 10–12, 1905.

The expenditures during the year for inspection and superintendence of levee work under contract, for hired labor work, and for surveys, amounted to $15,909.67. The sum of $1,442.56 was applied to office expenses.

Under authority of the Secretary of War, and with the opinions of the Attorney-General that the United States would acquire valid titles, settlements amounting to $1,175 were made of judgments of United States courts awarding damages for right of way of the West Pass levee, and, with War Department approval, title to the additional 9.53 acres referred to in the last report (Report Chief of Engineers, 1904, p. 2053) is to be acquired at private sale when deeds are received from the Department of Justice.

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For detailed information respecting this work, reference is invited to the appended report of Mr. T. C. Thomas, assistant engineer, under whose local supervision it was conducted.

Since the opening of the canal diversion route in January, 1903, there has been an average increase in width of about 18 per cent, an average increase of depth of about 43 per cent, and an increase of canal prism of about 90 per cent, most of which occurred during last January and February, owing to the unusual conditions of low water in the Mississippi River and a flood out of Yazoo River. An abnormal slope and velocity was thus induced in the canal sections, reaching a maximum fall averaging about 3.6 feet per mile, and a mean velocity of about 12.7 feet per second at the city front. At certain points in the canal the rate of fall and mean velocity undoubtedly greatly exceeded these figures.

The result of these great changes, when low stages are reached, can not certainly be predicated; it is safe to assume, however, that they will affect the low-water slope considerably. Unless the great depths scoured out near the head of the two divisions are subsequently filled with deposit—of which there is little probability—there is danger that most of the fall will be concentrated at these points and that the current created will scour out channels of increased section back into Lake Centennial and Old River, resulting eventually in the lowering of these pools. As the lower end of Yazoo River from Snyders Bluff—a distance of 10 miles—has also the nature of a pool, it will be lowered by any lowering of Old River and may render the shoals in this section obstructions to navigation.

Some dredging may be necessary in Lake Centennial at the mouth of the main cut, where a deposit of 1,635,200 cubic yards over an area of 157 acres has been made, the maximum fill being 21.7 feet.

As soon as the water has fallen and the conditions obtaining have developed, a special report will be submitted, with recommendation as to what steps should be taken to conserve the interests of navigation. The balance available for work that may be necessary is $20,570.75.

Money statement.

July 1, 1904, balance unexpended	$76,646.06
June 30, 1905, amount expended during fiscal year, for works of improvement	55,856.93
July 1, 1905, balance unexpended	20,789.13
July 1, 1905, outstanding liabilities	218.38
July 1, 1905, balance available	20,570.75

LIST OF APPROPRIATIONS—EXISTING PROJECT.

July 13, 1892	$75,000
August 18, 1894	225,000
August 18, 1894	40,000
June 4, 1897	350,000
March 3, 1901	510,000
Total	1,200,000

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REPORT OF MR. T. C. THOMAS, ASSISTANT ENGINEER.

VICKSBURG, MISS., *June 30, 1905.*

CAPTAIN: I have the honor to submit the following report on the improvement of the mouth of Yazoo River and harbor at Vicksburg during the fiscal year ending June 30, 1905.

WEST PASS LEVEE.

The greater part of this levee was built during the latter part of 1903. The work was suspended during high water of 1903–4, but resumed in latter part of May, 1904. On July 1, 1904, the working force and outfit were largely increased, and the work prosecuted as rapidly as the river stage would permit, operations being at first confined to section No. 1, at the upstream end of the levee. Work was restricted to this section until August 22, when about half the force was transferred to section No. 4, at the downstream end of the levee. Section No. 1 was completed September 24 and section No. 4 on the 30th of same month. The work was hampered during July by heavy rains and by the comparatively high river stage, which put the ground water close to the surface and necessitated shallow borrow pits. Conditions were favorable during the remaining time except for a period of excessively hot weather in August.

The levee is 1,100 feet shorter than was originally contemplated, five stations being cut off at the upstream and six at the downstream end. This curtailment of the work was decided on because of the practical working of the levee, as built in 1903, during the high water of 1904. The object of the levee is to stop a circulating current, which, under former conditions and at stages above 30 feet on the engineer gauge at Kleinston Landing, was thrown off by the eddy in the Mississippi at mouth of canal, and which passed slowly up the harbor division of canal, dropping much of its sediment en route, and returned to the Mississippi through the west branch of Lake Centennial and across the low neck separating the lake and river.

The levee as built in 1903 traversed this dividing ground and extended about 500 feet upstream and 700 feet downstream beyond the ends of the neck proper.

The high water of 1904 was above the 30-foot stage at Kleinston from March 30 to June 1, and there was a discharge from lake to river past the downstream end of levee from April 1 to May 28, and around the upstream end from April 5 to May 26, the outflow at this end of levee extending at the highest stage (46.85 feet) about 1 mile farther upstream. Notwithstanding this free outflow around the ends of the incompleted levee, there was at no time during this period an inward current in the canal, and test soundings showed that little or no fill occurred. It was apparent that the levee as then constructed would serve the purpose for which it was designed, but it was advisable to extend the levee some distance upstream to guard against a flanking channel from the lake to river, and to build a curved spur at the downstream end for the better protection of that end.

The necessity of providing for the floods of the Yazoo basin an exit to the Mississippi as ample as the local conditions would permit made it advisable to limit the levee to the minimum length under which it would serve the particular purpose for which it was built, and also have its ends reasonably secure.

The modification of the original plan was covered by a supplementary agreement with Messrs. Helgason Bros. & Garbish, the contractors for sections Nos. 1, 2, and 4, under which they received the sum of $4,500 by way of compensation for losses sustained by them on account of the curtailment of the work.

TABLE I.—*Cost of levee work during fiscal year ending June 30, 1905.*

Section.	Cubic yards.	Unit price.	Total cost.
		Cents.	
1	86,427	[a] 25	$21,606.75
3	1,296	[b] 48+	623.59
4	29,965	[a] 32½	9,738.63
Damages for curtailment of work	.....	.....	4,500.00
Inspection	.....	.....	405.00
Total	117,688	.....	36,873.97

[a] Contract price.

[b] By force account. This fill was made behind the protection bulkhead at upstream end of levee as built in 1903. Part of this was rehandled—by force account—when the bulkhead was removed in 1904; $548.48 of the total cost has been reported under head of end protection work in Report of Chief of Engineers for 1904, page 2060.

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The above is exclusive of 313,285 cubic yards put up during the fiscal year ending June 30, 1904, at a cost of $102,237.96. (See Report Chief of Engineers, 1904, p. 2056.)

A small force has been maintained on the levee for the greater part of the year doing general repair work. Immediately after the recession of the high water of 1904 this force rebuilt 660 feet of damaged bulkhead (wave-wash protection) and resodded the lower slopes of the levee where the grass had been damaged by long submergence; 1,085 cubic yards of material taken out by wave wash was replaced, principally by shovel work, at a cost of $134; the temporary protection work at upstream end of levee (as built in 1903) was removed at a cost of $140, and 403 squares of the temporary protection mattress at the downstream end was removed at a cost of $156. Weeds were mowed several times, and all exposed surfaces of the bulkheads built in 1903 for wave-wash protection were painted with tar.

The levee was finished so late in the season that part of the sodding was ineffective, and the heavy rains in the early part of 1905 did much damage to the levee slopes. The permanent force resodded the levee where necessary and has surfaced the slopes of the newer portion of the work several times.

LEVEE PROTECTION WORK.

The permanent protection work at the upstream end of levee consists of a paving covering the sloping end of the embankment and the side slopes for a distance of 100 feet back from the end of levee crown, together with a paving 60 feet wide on the natural ground surface laid continuous with the paving on the slopes.

Paving consists of riprap laid close by hand, with the larger voids chinked with spalls, except for the sloping end and the adjacent pavement, where the riprap is laid on a 3-inch layer of spalls. Around the outer edge of the paving is a trench 2½ feet deep filled with selected heavy riprap.

The greater part of the rock was unloaded on the river bank, 1,200 feet from end of levee, during the high-water season of 1904, the remainder being that used in the temporary protection work at upstream end of levee as built in 1903, and involving a haul of 3,700 feet. Hauling was done by contract, delivery of rock beginning July 15 and continuing until the middle of September.

Paving was laid by force account. The work began July 22 and was completed on September 23, being prosecuted intermittently as rock was available, the force being employed in removing temporary protection work, repairing wave wash, etc., at other times.

The permanent protection work at the downstream end of levee consists of a riprap paving on the levee slope, beginning 100 feet back from end of crown on lake side, extending around the sloping end, and continuing along the river slope for a distance of 555 feet, the ground surface adjacent to the paved slopes being covered with a mattress 85 feet wide, built continuous with the paving. On the river side the new work—paving and mattress—joins on to a portion of the temporary protection work placed in 1903 around the end of the then uncompleted levee.

The paving is similar to that around upstream end of levee, but somewhat lighter. The riprap is laid on spalls around the sloping ends, but on the earth slopes for the remaining portion. The mattress consists of an upper and lower pole grillage with two layers of brush between, the grillage systems being connected by wires passing through the brush, and carries about 35 pounds of riprap ballast to the square foot.

To prevent a concentrated flow through the borrow pit, river side, the pit is crossed by a series of pile and brush dikes having their crests on a level with the natural ground surface adjacent. The dikes are anchored to planks buried to a depth of 2½ feet and resting on cross heads nailed to the piles, which were set 6 feet in the ground with post-hole diggers. Scour underneath the brush filling of dikes is prevented by ballasted foot mats around the piles.

A small scraper force was employed October 3 to 7 in smoothing the portion of the borrow pit to be mattressed and sloping off the bank between the pit and levee berm. Stumps left in the pit were grubbed out.

Rock for paving and ballast had been unloaded on the canal bank, about 700 feet from the work, during the preceding high water. Rock hauling and paving began October 6, but was prosecuted with many interruptions, especially as to the paving, as the force had to be detailed on other work frequently. Brush cutting began at Longs bar, Louisiana, about 4 miles below mouth of canal, on October 3; began hauling brush to river bank October 12, and on the 14th began towing to mouth of canal. The snag boat *Thos. B. Florence* was used in towing and as quarters for the cutting party. The barge was borrowed from the fourth district, improving Mississippi River.

Piles for the dike were obtained in the willow flat between the canal and west

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branch of Lake Centennial, about 7,000 feet from the work. The greater part of these were cut and hauled during October, as opportunity offered. Brush filling for the dikes was obtained from the same willow flat, 80 cords being cut from ground adjacent to the work and 100 cords about 4,000 feet to the north. Mattress construction began October 19, and was prosecuted as the necessary material became available. Piling and anchorages for stretches of dike included in the main mattress were set before construction of the latter was begun. Paving, mattress construction, and dike work were completed November 9, December 19, and December 21, respectively.

The work was greatly hampered by scarcity of labor, necessitating frequent redistribution and shifting of the force. At the low river stage prevailing while towing was in progress, the flat fore shore of the willow bar held the barge some distance out from the water's edge, necessitating a long carry and making this feature of the work slow and expensive. The lack of a proper number of barges, and of labor to load and unload them promptly, rendered it impracticable to keep the snag boat steadily employed in towing, though it was necessary to keep her constantly in commission, and still further increased the cost of brush and poles as delivered at the mat.

The brush cutting, loading and unloading wagons at Longs Bar, and about half the loading and unloading of barges, was done by subsisted labor, at the monthly rate of $30 per man, the average cost of subsistence being 32½ cents per ration (including cook's and waiter's wages). The remaining labor was employed by the day, at $1.25 per diem, except that a limited number of subsisted monthly laborers was used in completing the mattress and dikes. Messrs. Tate & Kirk, Vicksburg, Miss., furnished teams for hauling at a contract rate of $3.90 per day per team (including driver and wagon) at Longs bar, and $3.50 per day at downstream end of levee.

TABLE II.—*Cost of protection work (paving) at upstream end of West Pass levee.*

Designation.	Unit cost to nearest cent.	Total.
Superintendence		$40
Labor, 163 days	$1.25	204
Hauling, 219 cubic yards rock, 3,700 feet	.58	127
Hauling, 1,566 cubic yards rock, 1,200 feet	.39	605
Rock, 1,785 cubic yards on river bank	2.53	4,519
414 squares	13.28	5,495

Rock cost $2.18 per ton (0.862 cubic yard) on river bank. (See Report Chief of Engineers, 1904, p. 2059.) Hauling done by contract at rates of 50 cents and 33½ cents per ton for long and short hauls, respectively.

TABLE III.—*Cost of protection work at downstream end of West Pass Levee.*

[(*a*) Paving.]

Designation.	Unit cost to nearest cent.	Total cost.
Superintendence		$146
Labor, laying rock, 320 days	$1.25	400
Hauling 2,157 cubic yards of rock	.23	487
Rock, 2,157 cubic yards on river bank	2.53	5,461
694 squares	9.36	6,494

[(*b*) Mattress.]

Superintendence		$182
Grubbing and grading		198
Labor, constructing mattress		965
Subsistence for part of labor		35
Hauling 1,743 cubic yards of rock	$0.23	393
Rock, 1,743 cubic yards on river bank	2.53	4,414
Brush, at mattress, 1,139 cords	2.61	2,976
Poles, at mattress, 2,560	.20	503
Wire, 1,100 pounds	.02	26
Nails, 600 pounds	.02	13
Staples, 360 pounds	.02	8
1,162 squares	8.38	9,733

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TABLE III.—*Cost of protection work at downstream end of West Pass Levee*—Continued.

[(c) Brush dikes.]

Designation.	Unit cost to nearest cent.	Total cost.
Superintendence		$36
Labor, building dikes		138
Subsistence for part of labor		15
Piles, 480	$0.07	33
Brush, 80 cords, 600-foot haul	.76	61
Brush, 100 cords, 4,000-foot haul	.98	98
Lumber, 6½ thousand feet B. M	12.86	82
Nails, 175 pounds	.02	4
1,414 linear feet of dike	.34	467

The cost of 198 squares of foot mats under portions of dikes lying outside the main mattress is included in section (*b*) of above table.

TABLE IV.—*Approximate distribution of cost of principal materials used in mattress construction.*

	Rock (per cubic yard).	Brush (per cord).	Poles (per pole).
Cutting privilege		$0.02	
Cutting		.25	$0.02
Hauling to bank, loading and unloading		.11	.01
Team hire		.28	.02
Loading and unloading barges		.68	.06
Towing		.44	.03
Hauling bank to mattress, loading and unloading	$0.07	.12	.01
Team hire	.14	.19	.01
Superintendence	.02	.18	.01
Subsistence		.34	.03
Total	.23	2.61	.20

For cost of rock on river bank, see footnote to Table II.

During December the bulkhead protection work on river side of levee was extended from end of levee as built in 1903 upstream for a distance of 336 feet, protecting from wave wash that portion of the levee extension of 1904 which has no timber growth on its front. The bulkheads were constructed essentially as those on the older part of the levee (see Report Chief of Engineers, 1904, p. 2056), except that the plank sheathing was put on horizontally instead of vertically, and all cracks were battened. The cost of the 336 feet of high bulkhead and 989 feet of low was $785, distributed practically as in the older work.

In latter part of December the upstream half of the levee was inclosed by a two-strand barbed-wire fence, starting from low water in the west branch of Lake Centennial and ending on the Mississippi bar opposite the west end of levee. The fence is 6,000 feet long and cost $99.

SURVEYS AND EXAMINATIONS.

A low-water survey was made of canal October 24 to November 14 from head of dredged channel in Old River to deep water in the Mississippi. Cross sections were sounded at about 1,000-foot intervals and wye levels run to water surface at all sounding ranges. This survey was duplicated March 8 to 18, to determine the changes brought about by the freshet out of the Yazoo during January and February. In April a survey was made of the portion of Lake Centennial fronting the mouth of main cut of the canal to determine what fill had taken place.

Slope gauges, established at intervals along the canal, were read twice a week during July and August, and again from November to date. During and since January daily readings have been taken on gauges in Old River and Lake Centennial. The daily readings of the Mississippi River Commission gauge at Kleinston Landing, mouth of canal, were furnished by the Commission observer up to the end of April and since that time by the local office of the Weather Bureau.

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Longitudinal soundings have been taken through the canal once a month since September, except when a regular survey was in progress. Discharges were observed in the harbor division of canal on December 16 and 31 and February 15.

November 15 to 22 a survey was made of the left bank of the Mississippi River from King Point to the mouth of canal. Cross sections were taken from top bank out to river channel by levels and soundings at intervals of about 1,000 feet, using the ranges of the surveys of 1902 and 1903. This survey was duplicated in April from mouth of canal upstream for a distance of 4,000 feet.

November 23 to 30 a survey was made of the bar at old mouth of the Yazoo, covering same ground as the annual low-water surveys made at this place since 1902.

The canal survey of October and November was made at stages varying from 3.3 feet to 4.5 feet in the Mississippi River (on Kleinston gauge). The stage in Old River and the Yazoo was the lowest observed in many years. The salient features developed by the survey are given below:

TABLE V.—*Low-water widths and depths in Yazoo Diversion Canal, October–November, 1904.*

	Old River to Lake Centennial.	Lake Centennial to Mississippi River.	Remarks.
Water widths:	*Feet.*	*Feet.*	As found by survey:
Maximum	[a] 240.0	[b] 196.0	[a] Head of main cut. [b] Near mouth.
Minimum	[c] 108.0	[d] 131.0	[c] In Old River. [d] At South street, Vicksburg.
Mean	163.0	150.0	
Channel depths:			Reduced to 4-foot stage on Kleinston gauge.
Maximum	[e] 31.5	[f] 20.9	[e] Head of main cut. [f] Mouth of canal.
Minimum	[g] 5.4	[h] 10.9	[g] At Cattail Slough. [h] At mouth of Glass Bayou.
Mean	10.5	18.2	

The Yazoo River dropped to an unusually low stage in latter part of September and remained so until last week of December, the Mississippi averaging about 4 feet above local low water (—0.35 foot on Kleinston gauge, average for years 1891 to 1904, both inclusive).

The restricted water width on the city front inconvenienced the larger boats, especially when passing craft at anchor, but the depth was ample for the largest Mississippi steamers from the city landing out to the mouth of canal. In the main cut a stretch of thin water developed about half way between Lake Centennial and Barnett Lake on account of an abnormal widening of the canal at this point and the development of a channel against either bank. The depth was, however, more than sufficient for the class of boats plying in the Yazoo River and its tributaries. The banks were generally stable during the low-water period, the only marked exceptions being in Barnett Lake and at the mouth of Glass Bayou. The stretch of canal in Barnett Lake is excavated in the soft mud bed of the lake. During the first low-water season after the opening of the canal (1903) the banks of this stretch broke down to a uniform slope of about 4 to 1, but no serious slips occurred. A heavy slip occurred on right bank of canal near west end of lake in latter part of September, a second on the left bank about 300 feet below the first in October, and a third on right bank immediately below the first two in November. On December 12 two serious slips occurred near east end of lake, the banks coming in practically at opposite points, and contracting the waterway to about 40 feet. The points of the two latter were blown off with dynamite on December 12 and 13, widening the waterway to about 60 feet. All the slips extended back practically to the banks of the lake. A narrow and tortuous channel resulted through the lake, and the current in the contracted section became so heavy that upstream boats were compelled as a rule to haul through with lines. Glass Bayou is a hill stream emptying into the canal at the north boundary of the city of Vicksburg. A gravel bar has formed at mouth of the bayou, which forces the low-water discharge of the canal against the opposite bank and has caused considerable local caving. The point of the bar was blown off December 15, widening the low-water discharge section about 12 feet. During the last week of December brush was cut in the willow flat opposite and transported across the canal, with the intention of building a permeable dam in the bayou near its mouth, but a freshet out of the Yazoo prevented the completion of the project.

The freshet referred to above began December 24, the stage in Old River rising from 0.6 foot above low water[a] on date named to 13.1 feet above on January 4, and

[a] 7.1 feet—referred to the Kleinston gauge, as observed November 2, 1904.

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through January and February holding to an average elevation of 14.5 feet above local low water. During same period the Mississippi rose from 0.7 foot on the Kleinston gauge December 24 to 15.5 feet on January 29, declined to 5.75 feet February 14, then rose to 18.1 feet at end of month. The total fall through the canal increased from 7 feet December 24 to 16.2 feet on January 2; dropped, as the Mississippi River rose, to 6 feet on January 28; increased again, as the Mississippi fell, to 16.4 feet on February 12; then dropped to 4.9 feet February 28. The period of abnormal slope may be considered as ending February 20, when the fall from Old River to the Mississippi was 7.4 feet. The stage in Old River was not quite sufficient to overtop the bar at the old mouth of the river, and the whole Yazoo discharge passed through the canal.

The low-water discharge as observed at the Vicksburg front on December 16 was 2,349 cubic feet per second, the smallest yet observed for the Yazoo; the next in order being 2,530 cubic feet, found November 20, 1897, at the old mouth of the river. On December 31 the discharge through the canal was 16,598 cubic feet, and on February 15, 30,463 cubic feet, with a mean velocity of 12.7 feet per second at the place of observation—foot of Depot street, Vicksburg—on date last named.

The extreme current velocity obtaining during the greater part of January and February resulted in excessive bank and channel scour. True bank caving was most pronounced in the higher part of the batture at east end of the main cut, right bank; at mouth of Glass Bayou, both banks; and in the last 2,000 feet of canal immediately above the mouth, right bank. During the latter part of February three serious slips occurred on the left bank, all in the last 4,000 feet of canal. While the steepening of the bank by erosion may have aided, it is thought that these slips were primarily due to a combination of water impounded in the adjacent bottom land, soil saturation from rain and snow, and alternately freezing and thawing weather. Channel scour was greatest through Barnett Lake, where all material brought in by slips seems to have been swept out, and from the city (Vicksburg) landing out to the Mississippi. Test soundings indicate that the bar at mouth of Glass Bayou was largely dissipated into deeper water downstream.

The greater part of the material scoured from the main cut seems to have been deposited in Lake Centennial, the heaviest fill being in the prolongation of the main cut out into the lake, and dropping off most rapidly to the south of this line. The deposit in the first 900-foot extension of the main cut averages 6 feet above canal grade at this point (−4.7 feet on the Kleinston gauge), and 17.7 feet above lake bottom as surveyed in November, 1894, with a maximum fill of 21.7 feet since that year. The April survey of the portion of lake contiguous to the mouth of the main cut shows a deposit of 1,635,200 cubic yards since 1894 in the 157 acres covered by the examination, nearly all of which occurred during the recent freshet. Considerable fill has also occurred in the last 300 feet of the main cut, where the bottom rises to an average of 3 feet above grade, the deposit being traceable to the dissipation of the discharge over the low banks of the cut at stages exceeding 15 feet on the Kleinston gauge. The distance across the bar at mouth of main cut from the grade contour inside the dredged channel to same contour in the lake is 450 feet on the south side of the ridge of deposit on the prolonged center line, and 1,000 feet on the north side.

The changes in the canal prism since the completion of dredging, September, 1903, are indicated below.

TABLE VI.—*Present average widths, depths, and volumes of representative stretches of canal, with increase in these features since completion of dredging, September, 1903.*

Stretch of dredged canal.	Length.	Top bank width.	Increase.	Depth of cut.	Increase.	Volume of canal prism.	Increase.
	Miles.	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Cubic yds.*	*Cubic yds.*
In Old River	0.95	181	80	12	1	209,100	62,000
Old River to Barnett Lake	.54	417	40	63	15	1,700,100	756,500
Through Barnett Lake	.68	417	73	55	23	1,556,600	808,900
Barnett Lake to main bank Lake Centennial	.94	395	44	48	10	2,397,600	1,071,800
Main bank Lake Centennial to mouth of main cut	.81	364	89	25	5	1,244,200	656,900
Head of harbor division to city landing	.70	273	54	30	8	822,100	350,100
City landing to Mississippi River	1.37	393	62	50	18	3,063,300	1,440,500
Old River to Mississippi River.	5.99	346	52	40	12	10,983,000	5,146,700

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Some bottom fill has taken place at the upper end of the Old River stretch, and excessive bottom scour is found in the last 125 feet of this and the first 500 feet of the succeeding cut. This local scour is traceable to the eddy formed at the entrance to the main cut at stages overtopping the low banks of the Old River stretch, and most of it occurred shortly after the opening of the canal.

The increase in width and depth of canal is not adequate to explain the heavy increase in volume of canal prism. Most of the canal as originally dredged consisted of a narrow bottom cut from grade to 16 feet above, with a wide upper cut thence to ground surface (see Report Chief of Engineers, 1902, p. 1422); and most of the enlargement is due to the scouring away of the shoulders between the narrow and wide cuts. The greater part of the changes in canal, with the exception noted above, occurred during January and February of current year; and if the conditions then obtaining were the rule, the probability of the diversion channel for the Yazoo reaching a stable regimen would be small.

Fortunately the combination of a high stage in the Yazoo coincident with a low one in the Mississippi is of rare occurrence, having happened only twice before within the memory of old steamboat men, namely, in 1852 and 1873.

The slope through the canal is a function of the relative stages in the Mississippi and Yazoo rivers, and of the rate of change in these stages. Under ordinary circumstances the fall from Old River to the Mississippi varies from about 1 foot for a high stage in both rivers to 7 feet and over for coincident low waters, but under abnormal conditions it may range from a negative quantity to more than twice the usual fall at low water.

TABLE VII.—*Abnormal and representative slopes through the Yazoo Canal.*

Year and month.	Total fall— Old River to Lake Centennial, 3.73 miles.[a]	Total fall— Lake Centennial to Mississippi River, 1.99 miles.[a]	Stages (above local low water) and remarks. Yazoo River at Yazoo City.		Mississippi River at Kleinston Landing.	
	Feet.	Feet.	Feet.	Abnormal:	Feet.	
1904. Jan. 30	[b] Neg.	[b] Neg.	5.4	Rising 0.1 foot per day	14.4	Rising 3.5 feet per day.
1905. Feb. 12	8.1	8.3	4.5	Falling slowly	6.2	Falling slowly.
1904. Dec. 24 to 1905. Feb. 20	6.2	5.5	14.9	Rising rapidly until January 11, then slowly.	8.7	Fluctuated between 0.4 and 16.4 feet.
				Representative:		
1904. Apr. 2 to May 25	.6	.4	21.4	Rising slowly until April 26, then falling slowly.	43.7	Fluctuated between 37.8 and 47.2 feet.
July	.5	.6	9.5	Falling slowly	32.9	Nearly stationary.
Aug	.7	.9	4.0	.....do.....	24.4	Falling slowly.
Oct	2.6	1.3	− .2	Standing, practically	3.7	Do.
Nov	2.7	1.0	− .9	.....do.....	4.1	Rising slowly.
Dec. 1-24	4.8	2.2	.0	.....do.....	1.3	Falling slowly.
1905. Apr.....	+ .6	.6	20.2	Fluctuating, narrow limits.	33.7	Falling, generally.
May	− .6	.6	19.0	.....do.....	32.5	Rising, generally.
June....	.4	.4	15.4	Falling, generally	34.8	Falling, generally.

[a] Length of channel having exposed banks at low water; shorter than dredged cut.
[b] Total fall Mississippi River to Old River was 0.07 foot.

In above table low water in the Yazoo and Mississippi is taken as 1.95 feet and 0.35 foot below the zero of the gauge at Yazoo City and at Kleinston Landing, respectively; these being the means of the lowest annual gauge readings at the places named for the period 1891 to 1904, both years inclusive.

The November survey at the old mouth of the Yazoo shows a marked increase in the deposit at that place. The great body of the bar has an elevation of about 28 feet on the Kleinston gauge. A swale about 75 feet wide and 5 feet lower than the main fill crosses the bar along the old left bank of the Yazoo. The closure of the old mouth for ordinary river stages may be considered an accomplished fact.

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The November survey of the left bank of the Mississippi from Kings Point to mouth of canal point and fronting the West Pass levee shows no marked change since the survey of November, 1903, until within 4,500 feet of the mouth of canal. From this point downstream scour is indicated, most marked about opposite old West Pass, where the subaqueous bank has come in about 100 feet. Downstream from this point of maximum recession the subaqueous bank has receded about half the maximum. The upstream point at the mouth of canal has rounded off, giving easier access to the canal, especially for downstream boats. The April survey from mouth of canal upstream to West Pass and above shows no marked change since November, although the tendency is toward still farther recession. The slope of the subaqueous bank for this stretch varies somewhat irregularly from 4:1 to 8:1, and the average distance from crest of levee to top of the steep bank is between 600 and 700 feet.

A map showing the route of the canal from Old River to the Mississippi is published in the Report of the Chief of Engineers for 1902, page 1422, and a map showing the Yazoo, Old, and Mississippi rivers in the vicinity of Vicksburg is published in the Report of the Chief of Engineers for 1894, page 1494.

Very respectfully, your obedient servant,

T. C. THOMAS,
Assistant Engineer.

Capt. G. M. HOFFMAN,
Corps of Engineers.

V 6.

IMPROVEMENT OF YAZOO, TALLAHATCHIE, COLDWATER, AND BIG SUNFLOWER RIVERS, AND TCHULA LAKE, MISSISSIPPI.

The river and harbor act approved March 3, 1905, added Coldwater River to this group. The last appropriation for improving Coldwater River was made by act of June 14, 1880.

During the fiscal year ending June 30, 1905, operations were as follows:

(A) YAZOO RIVER.

The U. S. snag boat *Columbia*, James H. Britton, master, was employed in Yazoo River from September 1 to October 16, and from November 4 to December 26. Operations extended from mouth to head of the river, and the following obstructions to navigation were removed:

Snags pulled	695
Stumps pulled and destroyed	197
Logs removed from channel	26
Shore snags cut	65
Linear feet of wing dams built	225
Wrecks removed (part of C. S. transport *Ivy*, sunk 1862, at O'Neal Creek, and sunken barge above Rosebank)	2

November 16 to 27 the party under Overseer James H. Bobbs worked down Yazoo River from the mouth of Big Sunflower River to Vicksburg, cutting timber on sliding banks and destroying stumps, shore snags, etc., the following being a summary of the work performed:

Stumps cut and destroyed	237
Shore snags cut	497
Logs removed from channel	3
Leaning trees felled and cut up	1,980

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(B) TALLAHATCHIE RIVER.

The snag boat *Columbia* worked in this river from October 17 to November 3, between its mouth and Philipp, destroying the following obstructions to navigation:

Snags pulled	178
Stumps pulled	34
Logs removed from channel	18
Leaning trees felled and cut up	40

(C) BIG SUNFLOWER RIVER.

September 1 to 4 U. S. quarter boat *No. 2* was towed from Vicksburg to Osceola Landing. From September 5 to November 15 a party equipped with tools, tackle, explosives, etc., under Overseer James H. Bobbs, worked between Osceola and the mouth of the river, building and repairing wing dams to close chutes and to contract and scour the channel, and removing obstructions from the channel and banks. The following is a summary of the work performed:

Wing dams built (total length 5,700 feet)	15
Old dams repaired and strengthened	21
Snags and logs removed from channel	1,286
Shore snags cut	1,344

On June 26 the snag boat *Columbia* left Vicksburg with quarter boat *No. 2* and a pile driver barge in tow and reached Baird Landing, at the crossing of the Southern Railway, about 140 miles upstream, June 29. After leaving the tow at Baird, the snag boat worked downstream to Dogwood Landing, removing 2 snags at Panther Bend and 1 below Big Basin.

The party on quarter boat *No. 2* commenced clearing the banks of leaning timber and worked downstream one-half mile below Baird; 1,556 leaning trees were felled and cut up June 29 and 30.

(D) TCHULA LAKE.

The U. S. snag boat *Thos. B. Florence*, James H. Britton, master, was sent to Tchula Lake to remove formations of drift; left Vicksburg January 25 and returned February 3.

One-half mile above Marcella the channel—about 60 feet wide between willows—was found to be blocked for 100 yards by an accumulation of trees, logs, and drift. This jam was broken loose and kept in motion until it passed out into the wide channel of Yazoo River. The snag-boat then made a patrol through the lake and removed 5 logs from the channel and 2 large trees which had blown into the lake.

Of the available funds, the sum of $60,000 is to be applied to building a new steel-hull snag boat, and the remainder is for continuing work in the various streams during the next two years. The preparation of plans for the new snag boat has been commenced.

Reference is invited to the appended report of Mr. H. M. Marshall, assistant engineer.

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Money statement.

	Yazoo River.	Tallahatchie and Coldwater rivers.	Big Sunflower River.	Tchula Lake.	Total.
July 1, 1904, balance unexpended	$11,362.07	$915.88	$8,882.38	$1,184.44	$22,344.77
Amount appropriated by river and harbor act approved March 3, 1905[a]	[b]90,000.00	5,000.00	6,000.00	4,000.00	105,000.00
Amount received from sale of property	17.25				17.25
	101,379.32	5,915.88	14,882.38	5,184.44	127,362.02
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	7,114.73	735.44	4,486.42	394.96	12,731.55
July 1, 1905, balance unexpended	94,264.59	5,180.44	10,395.96	4,789.48	114,630.47
July 1, 1905, outstanding liabilities	18.91	10.75	88.83		118.49
July 1, 1905, balance available	94,245.68	5,169.69	10,307.13	4,789.48	114,511.98

[a] Allotments approved by Secretary of War April 7, 1905.
[b] Includes $60,000 for new snag boat.

LIST OF APPROPRIATIONS.

By act of—	Yazoo River.	Tallahatchie and Coldwater rivers.	Big Sunflower River.	Tchula Lake.	Total.
March 3, 1873	$40,000.00				$40,000.00
March 3, 1875	12,000.00				12,000.00
August 14, 1876	15,000.00				15,000.00
June 18, 1878	25,000.00				25,000.00
March 3, 1879	15,000.00	$13,000.00	$20,000.00		48,000.00
June 14, 1880	12,000.00	13,000.00	8,000.00		33,000.00
March 3, 1881	6,000.00	3,000.00	4,000.00	$3,000.00	16,000.00
August 2, 1882	8,000.00	3,000.00	5,000.00	2,500.00	18,500.00
July 5, 1884	10,000.00	3,000.00	5,000.00	1,500.00	19,500.00
August 5, 1886	15,000.00	3,500.00	5,000.00	2,000.00	25,500.00
August 11, 1888	32,000.00	5,000.00	5,000.00	3,000.00	45,000.00
September 19, 1890	25,000.00	5,000.00	5,000.00	3,000.00	38,000.00
July 13, 1892	20,000.00	5,000.00	5,000.00	3,000.00	33,000.00
August 18, 1894	20,000.00	4,000.00	5,000.00	3,000.00	32,000.00
June 3, 1896	20,000.00	4,000.00	5,000.00		29,000.00
March 3, 1899	20,000.00	5,000.00	5,000.00		30,000.00
June 13, 1902 (allotments)	21,000.00	10,000.00	20,000.00	4,000.00	55,000.00
March 3, 1905 (allotments)	90,000.00	5,000.00	6,000.00	4,000.00	105,000.00
Total amount appropriated	406,000.00	81,500.00	103,000.00	29,000.00	619,500.00
Total amount expended	311,735.41	76,319.56	92,604.04	24,210.52	504,869.53
Balance unexpended	94,264.59	5,180.44	10,395.96	4,789.48	114,630.47

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COMMERCIAL STATISTICS.

(A) YAZOO RIVER.

Yazoo River was navigable from mouth to head the entire fiscal year.

List of boats engaged in the trade during the fiscal year.

Name.	Class.	Tonnage.	Length.	Breadth.	Depth.	Draft.		Between—	Round trips.	Passengers.
						Light.	Loaded.			
			Feet.	*Feet.*	*Feet.*	*Feet.*	*Feet.*			
F. Weyerhauser[a]	Stern-wheel.	216	140	31.0	4.5	3.0	4.5	Vicksburg and mouth Sunflower.	....	....
American	do	190	158	27.6	4.2	1.9	5.5	Vicksburg and Greenwood.	6	208
Jack Osborn	do	125	120	30.0	5.0	1.9	3.5	Greenwood and Belzona.	90	....
Stella	do	83	101	25.0	3.0	1.7	4.0	Yazoo City and Belzona.	48	210
Edna	do	78	70	21.4	3.0	2.2	2.8	Vicksburg and local points.	20	....
H. C. Brockman[a]	do	75	91	22.6	3.8	2.0	3.0	Vicksburg and mouth Sunflower.	....	....
C. J. Reynolds[a b]	do	71	112	22.1	2.6	2.0	2.0	New Orleans and Sátartia.	....	....
Imoyne	do	51	.....	.....	.....	1.0	3.0	Belzona and Greenwood.	4	....
Modoc	do	27	64	14.0	2.5	1.2	1.6	Vicksburg and Belzona.	12	....
Constance	Gasoline.	50	.....	.....	.....	0.5	2.0	Yazoo City and local points.	20	....
T. B. Butts	do	17	.....	.....	.....	1.2	2.0	Vicksburg and Greenwood.	11	....
Stella Guynn	do	14	50	12.0	2.5	1.3	1.7	Yazoo City and Belzona.	20	50
Angelina M.[b]	do	13	45	10.0	3.0	1.5	1.5	Yazoo City and Satartia.	6	....
								Vicksburg and Satartia.	1	....
Cody Hull[a]	do	9	65	12.8	2.0	1.3	2.1	Greenwood and Belzona.	32	....
Queen	do	.....	.....	.....	.....	1.5	2.0	Vicksburg and local points.	24	....

[a] Towboats. [b] With one or more barges.

Summary of commerce reported.

Articles.	1904–5.	Articles.	1904–5.
	Tons.		*Tons.*
Cotton	5,474	Grain	1,215
Cotton seed	7,416	Miscellaneous	4,424
Live stock	191		
Lumber	7,144	Total freights for Yazoo proper	108,183
Staves	4,250	Total for tributaries	66,239
Saw logs	75,000		
Provisions	3,069	Total for Yazoo and tributaries	174,422

Estimated value:

Yazoo proper	$2,916,300
Yazoo and tributaries	5,458,550

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(B) TALLAHATCHIE RIVER.

During the fiscal year ending June 30, 1905, Tallahatchie River was navigable to Sharkey and to mouth of Coldwater River from January to June, inclusive.

List of stern-wheel steamboats engaged in the trade during the fiscal year.

Name.	Tonnage.	Length.	Breadth.	Depth.	Draft.		Between—	Round trips.
					Light.	Loaded.		
		Feet.	*Feet.*	*Feet.*	*Feet.*	*Feet.*		
Choctaw	223	127	24	4.0	1.7	3.5	Greenwood and St. Elmo	123
Jack Osborn	125	120	30	5.0	1.9	3.5	Greenwood and local points	3
Imoyne	51	.....	.....	.....	1.2	2.5	Not reported	60
Maggie	50	85	19	3.5	1.9	3.5	Greenwood and Lone Star	64
							Greenwood and Marks	26

Summary of commerce reported.

Articles.	1904–5.	Articles.	1904–5.
	Tons.		*Tons.*
Cotton	4,474	Provisions	1,921
Cotton seed	8,473	Grain	5,610
Live stock	52	Miscellaneous	1,946
Lumber	2,800		
Staves	60	Total	25,336

Estimated value, $1,248,000.

(C) BIG SUNFLOWER RIVER.

The river was reported navigable for light-draft boats during the entire fiscal year.

List of boats engaged in the trade during the fiscal year.

Name.	Class.	Tonnage.	Length.	Breadth.	Depth.	Draft.		Between—	Round trips.	Passengers.
						Light.	Loaded.			
			Feet.	*Feet.*	*Feet.*	*Feet.*	*Feet.*			
F. Weyerhauser [a]	Stern-wheel.	216	140	31.0	4.5	3.0	4.5	Vicksburg and local points.	.....	.....
Osage	....do	98	100	19.8	3.8	2.0	2.5	.....do.....	115	.....
Stella	....do	83	101	25.0	3.0	1.7	4.0	Yazoo City and local points.	32	140
H. C. Brockman [a]	....do	75	91	22.6	3.8	2.0	3.0	Vicksburg and local points.	.....	.....
Steamer B	....do	15	.....	.....	.....	1.6	2.0	.....do.....	52	.....
Steamer C	....do	10	.....	.....	.....	1.2	1.7	.....do.....	10	.....
Pearl [b]	Gasoline.	14	.....	.....	.....	1.4	1.9	Vicksburg and Woodburn.	27	.....
Pride of Virginia	....do	14	50	12.0	2.5	1.5	1.7	.....do.....	43	250
Angelina M	....do	13	45	10.0	3.0	1.5	1.5	Vicksburg and Goff Landing.	2	.....
Cody Hull [a]	....do	9	65	12.8	2.0	1.3	2.1	Vicksburg and Woodburn.	.....	.....

[a] Towboat. [b] With barge.

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Summary of commerce reported.

Articles.	1904–5.	Articles.	1904–5.
	Tons.		*Tons.*
Cotton	2,172	Provisions	2,214
Cotton seed	1,880	Grain	2,950
Live stock	248	Miscellaneous	2,238
Lumber	2,500		
Staves	2	Total	39,874
Saw logs	25,720		

Estimated value, $1,229,250.

(D) TCHULA LAKE.

During the fiscal year Tchula Lake was reported navigable from January to June, inclusive.

List of boats engaged in the trade during the fiscal year.

Name.	Class.	Tonnage.	Length.	Breadth.	Depth.	Draft.		Between.	Round trips.
						Light.	Loaded.		
			Feet.	*Feet.*	*Feet.*	*Feet.*	*Feet.*		
Jack Osborn	Stern-wheel	125	120	30	5	1.9	3.5	Greenwood and local points.	3
Imoyne		51				1.2	2.5	do	25

Summary of commerce reported.

Articles.	1904–5.
	Tons.
Cotton	220
Cotton seed	600
Provisions	112
Grain	67
Miscellaneous	30
Total	1,029

Estimated value, $60,000.

April 24, 1905, requests were sent to the boards of trade at Vicksburg, Yazoo City, and Greenwood, Miss., for reliable information of the effect of the project upon freight rates. The following reply was received from the Vicksburg Board of Trade. No responses have been received from the other cities.

BOARD OF TRADE OF VICKSBURG,
Vicksburg, Miss., May 31, 1905.

Capt. G. M. HOFFMAN.

DEAR SIR: I must ask your pardon for my failure to send you promptly the information given below regarding freight rates from Yazoo River points to Vicksburg. We have been so constantly engaged in work on our Valley Park-Silver City Railroad extension that it has been impossible for me to keep up with other work.

Rates to Vicksburg from Yazoo River points.

	By boat.	By rail.
Cotton, per bale	$0.50 to $0.75	$1.00 to $1.50
Cotton seed, per ton	1.50 to 2.00	2.00 to 3.00
Live stock, per head	2.50	7.50
Grain, flour, meal, and provisions, per 100 pounds	.10 to .12½	.15 to .20

To inland points, while there is no fixed class rate by river, the rates would figure somewhat as follows:

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One hundred miles inland.

	Class and rate (cents).											
	1.	2.	3.	4.	5.	6.	A.	B.	C.	D.	E.	F.	G.
By rail	60	49	43	36	30	26	18	28	28	15	34	40	43
By boat	40	35	30	25	20	15	12	12	12	10	20	20	25

Rates by rail are not usually advanced during periods when navigation is suspended, because it is realized that the suspension is only temporary. If, however, navigation were permanently suspended, it is safe to say that an advance over existing rates would be made at once.

An enormous amount of timber is "rafted" by river, particularly from the Yazoo River section and through the tributaries of the Yazoo River to the mills at Vicksburg. This timber could not be reached by rail, coming as it usually does from very low lands.

Trusting that the information given may be of service to you, and again regretting the delay in sending it, I am,

Very respectfully,

FRANK H. ANDREWS,
Secretary.

REPORT OF MR. H. M. MARSHALL, ASSISTANT ENGINEER.

MONROE, LA., *June 30, 1905.*

CAPTAIN: I have the honor to submit the following report on general improvement of Yazoo, Tallahatchie, Coldwater, and Big Sunflower rivers and Tchula Lake, Mississippi, for the fiscal year ending June 30, 1905.

At the beginning of the fiscal year all boats were laid up in the lake near Vicksburg, Miss., under the care of J. H. Britton, master of U. S. snag boat *Columbia*. Minor repairs were made and painting done until September 1, when the *Columbia* left for Yazoo River under command of J. H. Britton. Work was carried on upstream to the mouth of Yalobusha River till September 30. The boat then moved down to Honey Island, 39 miles below Greenwood. There a wing dam of trees and brush was built 175 feet long, which increased the depth from 20 inches to about 3 feet. Another wing dam of like character 150 feet long was built at Gold Dust bar, which also improved the depth of the river. Work was carried on upstream till October 17, when the boat entered Tallahatchie River, returning to Yazoo November 4, and worked back and forth below Yazoo City till laid up at Vicksburg, Miss., December 28, 1904.

November 16 to 27 the chopping party under Overseer J. H. Bobbs, which had been working in Big Sunflower, worked from there to mouth of Yazoo.

The highest and lowest stages reached on Yazoo River during the year, as reported by the Weather Bureau, were as follows:

Station.	Highest reading.		Lowest reading.		Range (in feet).
	Date.	Feet.	Date.	Feet.	
	1905.		1904.		
Greenwood[a]	Feb. 23, 24	29.6	Nov. 1, 14–17	−0.1	29.7
Yazoo City	Mar. 20, 22–29, and Apr. 4.	21.5	Nov. 16–21 and 26–30	−3.0	24.5

[a] Established Nov. 1, 1904.

TALLAHATCHIE RIVER.

From October 17 to November 3, 1904, the U. S. snag boat *Columbia*, J. H. Britton, master, worked between the mouth of Tallahatchie River and Moss Place, 67 miles up, destroying shore snags and removing obstructions from the channel.

TCHULA LAKE.

January 25, 1905, the U. S. snag boat *Thos. B. Florence* left Vicksburg to remove a log jam in Tchula Lake one-half mile above Marcella and ran it out into Yazoo River. The boat returned to Vicksburg; then, February 1 to 3, made a patrol of the lake, but found it all clear.

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BIG SUNFLOWER RIVER.

The quarter boat and pile driver, with J. H. Bobbs, overseer, in charge, and 17 laborers on board, left Vicksburg September 1 in tow of the gasoline boat *Stella Gwinn* and arrived at Osceola Landing, on Big Sunflower River, September 4. Work was carried on downstream from September 5 to November 15, 1904, and consisted in building and repairing wing dams, cutting trees from the banks, and removing logs, snags, and stumps from the channel. Fifteen wing dams, having total length of 5,425 feet, were built and 20 dams were repaired. The depth of water at the shoals was increased from 16 inches to 2½ feet by the building of the wing dams.

June 25, 1905, the U. S. snag boat *Columbia*, J. H. Britton, master, left Vicksburg, having the quarter boat and pile driver, under Overseer J. H. Bobbs, in tow, and arrived at Baird, Miss., June 29. Both snag boat and quarter boat are working down the river at this date.

No gauges were kept on Big Sunflower River during the year.

Very respectfully, your obedient servant,

H. M. MARSHALL,
Assistant Engineer.

Capt. G. M. HOFFMAN,
Corps of Engineers.

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APPENDIX W.

IMPROVEMENT OF ARKANSAS RIVER AND OF CERTAIN RIVERS IN ARKANSAS AND MISSOURI.

REPORT OF MAJ. GRAHAM D. FITCH, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1905, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Arkansas River, Arkansas.
2. White River, Arkansas.
3. Upper White River, Arkansas.
4. Operating and care of Locks and Dams Nos. 1 and 2, Upper White River, Arkansas.
5. Cache River, Arkansas.
6. Black and Current rivers, Arkansas and Missouri.
7. St. Francis and L'Anguille rivers, Arkansas.
8. St. Francis River, Missouri.

ENGINEER OFFICE, U. S. ARMY,
Little Rock, Ark., July 10, 1905.

GENERAL: I have the honor to forward herewith annual reports for the fiscal year 1905 of the following-named works of river and harbor improvements under my charge. * * *

Effort was made to obtain information regarding the effects that river improvements have had on freight rates, and although the commercial organizations of the several river towns were written to, no information worth noting was received, therefore, this subject is not touched upon in the reports.

Very respectfully, your obedient servant,

GRAHAM D. FITCH,
Major, Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

W 1.

IMPROVEMENT OF ARKANSAS RIVER, ARKANSAS.

OPERATIONS THIS FISCAL YEAR.

Both of the snag boats, which were preparing for active work at the beginning of the fiscal year, were gotten to work early in the year, the *C. B. Reese* leaving Newport on the 5th of July, 1904, and beginning work at Poverty Point (8) on the 8th and the *Arkansas* beginning

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at Little Rock (174) on the 9th. With the exception of the *C. B. Reese* being employed on White River during the months of October and November, both boats were kept at work on this river until December 31, 1905, when it became necessary to suspend operations because of exhaustion of funds. At this time the river was at so low a stage that the boats could not be run to Little Rock, so both boats were laid up temporarily where they happened to be on that date, only sufficient crew being retained on them to take them to Little Rock when a rise should come. The *C. B. Reese* lay at Swan Lake, the *Arkansas* at Pine Bluff. It was not until late in February, 1905, that the boats were run to Little Rock, the *Arkansas* arriving there on the 26th of the month, the *C. B. Reese* on the day following. Both boats were then laid up permanently pending the action of Congress on a river and harbor bill. Such a bill having become a law and funds appropriated by it having become available, repair and overhaul of the *C. B. Reese* was begun April 16, 1905, and of the *Arkansas* May 1, 1905. Both boats resumed active work on June 13, 1905, the *C. B. Reese* beginning work at foot of Lakes Bend (66), the *Arkansas* at Devils Bend (194). The *C. B. Reese* is now working in the vicinity of Hannaberry and the *Arkansas* is in the vicinity of Wampoo.

Summary of work done by snag boats in Arkansas River, fiscal year 1905.

Date and snag boat.	Work done between—	Distance.	Snags removed.	Trees cut.	Drifts broken.	Miles run.
July, 1904:		*Miles.*				
Arkansas	Hensley Island and Shoal Creek	149	26	2,033		273
C. B. Reese	Poverty Point and Bankhead	77	42	1,369	2	426
August, 1904:						
Arkansas	Murdaugh and Eagles	93	101	3,900	1	183
C. B. Reese	Bickers and Pine Bluff	51	195	1,447	2	140
	Sawmill Bend and Hopedale	4				
September, 1904:						
Arkansas	Morgan Bend and Thedfords	25	193	455	2	87
C. B. Reese	Poverty Point and Arkansas Post	28	235	1,402		125
October, 1904:						
Arkansas	Southbend and Kimbroughs	23	142	1,438		69
November, 1904:						
Arkansas	Jardlow Point and Bickers	19	272	122		49
December, 1904:						
Arkansas	Vincennes Bend and Pine Bluff	48	121	1,178		62
C. B. Reese	Poverty Point and Rafelds	35	272	60		93
	Cummins and Swanlake	11				
June, 1905:						
Arkansas	Wampoo and Lewisburg	82	45	2,076	1	142
C. B. Reese	Bickers and Simpsons	20	43	2,900		169
Total	Poverty Point and Shoal Creek	273	1,687	18,380	8	1,818

In July, 1904, a "cut-off" was made by the river at Pawpaw Landing, 25 miles below Little Rock. In June, 1905, a "cut-off" was made by the river at Spellmans Point, 30 miles below Pine Bluff. Each of these "cut-offs" caused a local shortening of the river of about four miles, and as a consequence the river banks for several miles each way from them are caving badly. During the high-water period of June and July, 1904, the river carried an unusually large quantity of drift. At the Memphis, Helena and Louisiana Railway bridge, then under construction, near Garland Lake (19 miles above the mouth of the river), the drift accumulated in a jam reaching from pier to pier. This jam forced the water against the north bank of the river, which caved about 300 feet, leaving what was the north bank pier of the

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bridge some 275 feet out in the river and nearly filled the south draw opening with a sand bar. The railway company removed much of the drift, but as some of it was too heavy to be moved by the plant controlled by the company, the snag boat *C. B. Reese* was loaned the company for five days in July for this work, the railway company paying all the expenses of the boat during that period. Subsequently the cut around the north pier enlarged and the sand bar enlarged until it closed both draw openings. By means of dikes the railway company has forced the channel back into the north opening. High water caused a cessation of work before the company's project was completed, and as yet it is not known that the work will produce satisfactory results.

A peculiar freshet occurred in October, 1904. It was due to floods in the Canadian River (Indian Territory), and was so heavily laden with washings from the red clay beds of that district that the water could not be used in the boilers of the steamboats on the river. The duration of the freshet was fourteen days, and for ten days of this time all steamboat navigation was suspended.

Effort was made to obtain one of the Mississippi River hydraulic dredges for use in experimental dredging on this river, for which purpose $49,530 is available from the appropriation made by act of June 13, 1902. The effort was not successful, as the dredges were needed on the Mississippi River. It may be that conditions on that river may be such during the coming low-water season that one of the dredges can be spared long enough for a test to be made of hydraulic dredging on this river.

The Suter Dike, originally built for the purpose of maintaining the channel along the steamboat wharf at Fort Smith, and rebuilt for the purpose of maintaining the channel through the draw spans of the Kansas and Arkansas Valley Railway bridge (Missouri Pacific system), was breached during the high waters of June and July, 1904, and the draw openings of the bridge are now closed by a sand bar. Boats drawing not more than two feet can pass over the bar when the river is at 12 feet on the Fort Smith gauge. If the boats are not over 26 feet high, they can also go under the fixed spans of the bridge at this stage. The only boat operating out of Fort Smith is such a boat, hence has not been materially hindered by the sand bar; going under the bridge when the river was below 12 feet on the gauge, and going over the bar when the river was above 12 feet on the gauge. From an examination made of this locality during the low-water season of 1904, the cost of repairing and strengthening the dike was estimated at $13,500. As the permanent removal of the bar may be contingent upon the rectification of the river for about 3 miles above the bridge, at a probable cost of $110,000 to $115,000, recommendation was made that nothing be done in the premises. Should commercial interests increase and larger boats be needed for this trade, something will have to be done.

Of the available balance, $49,530 will be expended in the experimental dredging previously referred to, provided a suitable dredge can be obtained, and $26,174.14 will be expended in operating and maintaining snag boats. Since a revetment in Red Fork Bend would be of no benefit to navigation, no expenditures from the $30,000 appropriated by act of March 3, 1905, for the purpose, are contemplated, authority having been granted to withhold a project for its expenditure for the present.

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The $35,000 estimated as being needed during the fiscal year ending June 30, 1907, is for maintenance of channel by means of snagging operations.

Money statement.

July 1, 1904, balance unexpended		$71,630.56
Amount appropriated by river and harbor act approved March 3, 1905		65,000.00
Amount allotted from appropriation for maintenance of river and harbor improvements, act of April 28, 1904		1,000.00
		137,630.56
June 30, 1905, amount expended during fiscal year:		
For maintenance of improvement	$29,527.83	
Deposited to credit Treasurer United States	498.59	
		30,026.42
July 1, 1905, balance unexpended		107,604.14
July 1, 1905, outstanding liabilities		1,900.00
July 1, 1905, balance available		105,704.14
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905		35,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

APPROPRIATIONS.

July 3, 1832: For improving the navigation of the Arkansas River, Arkansas, Indian Territory, and Kansas (less $38 carried to surplus fund)	$14,962.00
March 3, 1835: For improving the navigation of the Arkansas River	40,000.00
March 3, 1837: For continuing the works	25,000.00
July 7, 1838: For the improvement of the Arkansas River (less $1,155.66 carried to the surplus fund)	38,884.34
From appropriations 1842–1844 (estimate)	80,000.00
August 30, 1852: For the improvement of the Arkansas River (less $269.47 carried to surplus fund)	39,730.53
From appropriations 1866–1878 (disbursements reported by Colonel Suter)	344,831.59
April 14, 1876: For removing the bar at Fort Smith, Ark	10,000.00
June 18, 1878: For removing the bar in the Arkansas River at Fort Smith	10,000.00
March 3, 1879:	
For improvement of Arkansas River between Fort Smith, Ark., and Wichita, Kans	20,000.00
For removing snags, sand bars, wrecks, and other obstructions, and correcting and deepening the channel * * * on the Arkansas River	30,000.00
June 14, 1880:	
For improvement of Arkansas River between Fort Smith, Ark., and Wichita, Kans	15,000.00
For improving Arkansas River at Pine Bluff	25,000.00
For removing snags, wrecks, and other obstructions * * * on the Arkansas River	35,000.00
March 3, 1881:	
For improving Arkansas River between Fort Smith, Ark., and Wichita, Kans	24,000.00
For improving Arkansas River at Pine Bluff	23,000.00
For improving the Arkansas River	25,000.00
August 2, 1882:	
Continuing improvement between Fort Smith, Ark., and Wichita, Kans	20,000.00

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August 2, 1882—Continued.	
Continuing improvement at Pine Bluff, Ark	$20,000.00
Continuing removal of snags, wrecks, * * * from the Arkansas River	35,000.00
July 5, 1884:	
For survey of the Arkansas River from Little Rock to the mouth.	19,000.00
Improving Arkansas River at Pine Bluff, Ark	55,500.00
For removing obstructions in Arkansas River from its mouth to Wichita, Kans	36,000.00
For the protection of the harbor at Fort Smith, Ark	5,000.00
August 5, 1886:	
Continuing improvement, according to plan and recommendation in Appendix V 13, Executive Document No. 1, Forty-ninth Congress	75,000.00
For the removal of snags, wrecks, and other obstructions	19,875.00
August 11, 1888:	
Continuing improvement * * * between Wichita, Kans., and the navigable mouth of the Arkansas River	150,000.00
For removing obstructions	25,000.00
September 19, 1890:	
Continuing improvement from Wichita, Kans	180,000.00
For operating snag boats and removing obstructions	20,000.00
July 13, 1892:	
Improving Arkansas River, Arkansas and Indian Territory	250,000.00
Removing obstructions and operating snag boats	20,000.00
August 18, 1894:	
Continuing improvement ($10,000 may be used in removing obstructions and operating snag boats)	250,000.00
Removing obstructions and operating snag boats	20,000.00
June 3, 1896:	
Continuing improvement ($15,000 may be used in removing obstructions and operating snag boats)	100,000.00
Removing obstructions and operating snag boats	20,000.00
March 3, 1899:	
Continuing improvement ($50,000 may be used in removing snags, sand bars, and other obstructions)	100,000.00
Removing obstructions and operating snag boats	20,000.00.
June 13, 1902: Continuing improvement and for maintenance, including the general improvement and removing obstructions and operating snag boats	110,000.00
March 3, 1905:	
For maintenance of improvement	35,000.00
For revetment work in vicinity of Red Fork, provided it is required in the interest of navigation	30,000.00
Total appropriations	2,415,783.46
September 15, 1900: Allotted from emergency river and harbor act June 6, 1900, for repairs to Red Fork revetment	10,000.00
June 7, 1904: Allotted from emergency river and harbor act, approved April 28, 1904	20,000.00
February 18, 1905: Allotted from emergency river and harbor act, approved April 28, 1904	[a] 501.41
Total appropriations and allotments	2,446,284.87

EXPENDITURES.

For removing obstructions and operating snag boats	1,100,779.66
For original construction of works for permanent improvement, including survey of river from Little Rock to the mouth	903,311.93
For maintenance of works for permanent improvement	334,589.14
Total expended to June 30, 1905	2,338,680.73
Unexpended July 1, 1905	107,604.14
	2,446,284.87

[a] $1,000 less $498.59 not used and returned to Treasury.

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COMMERCIAL STATISTICS.

No report was received of any navigation between Fort Smith and Cardens Bottoms, 125 miles below.

List of vessels that navigated Arkansas River from May 31, 1904, to June 1, 1905.

Name.	Net tonnage.	Draft loaded. Steamer.	Draft loaded. Barges.	Between—	Round trips.	Passengers.
		Ft. in.	Ft. in.			
Chicago	49	3 3	.....	Greenville and Simpsons	16	.....
Hazel Rice	138	3 6	6 0	Helena and Hannaberry	27	.....
Roan	39	2 0	.....	Arkansas City and Sarassa	12	.....
Climax	49	3 0	.....	Rafting out of lower river to Arkansas City.	12	.....
Mary D	40	2 6	2 0	Fort Smith and Grand River	4	18
				Fort Smith and Webbers Falls	98	
Lux McFadden	.....	1 1	1 2	Pine Bluff and Red Bluff	80	100
W. M. Gladden	50	2 6	.....	Lewisburg and Martins	7	60
A. D. Allen	67	4 0	.....	Little Rock and Pine Bluff	26	256
Truman	16	2 0	3 0	Little Rock and Perryville	12	.....
				Little Rock and Ledwidge	22	.....
				Little Rock and Eagles	28	
Henry Sheldon	220	3 6	.....	Little Rock and Pine Bluff	2	343
				Little Rock and Cardens Bottoms	23	
				Excursion trips	78	16,733
Greyhound	9	6 0	5 0	Arkansas City and Arkansas Post	1	.....
Evening Star	28	4 0	.....	Towing timber out of lower river to Rosedale.	5	.....
Myrtle Corey	9	2 0	.....	Poverty Point to Little Rock	1	.....
Birmingham	187	5 0	6 0	South Bend and St. Louis	12	.....
				Memphis and Little Rock	2	
				Memphis and Pine Bluff	17	
J. N. Harbin	266	3 0	.....	Memphis and Carsons	1	821
				Memphis and Heckatoo	3	
				Memphis and Little Rock	8	
Lucille Nowland	298	5 0	.....	Memphis and Pine Bluff	18	2,256
				Memphis and Silver Lake	1	

Classification of commerce reported year ending May 31, 1905.

Articles.	Quantity.	Articles.	Quantity.
	Tons.		Tons.
Cotton	2,063	Saw logs	38,555
Cotton seed	3,205	Shingles	1,020
Grain	3,840	Staves and bolts	12,020
Hides	37	Railway ties	8,387
Live stock	567	Miscellaneous freights	4,916
Lumber	6,536		
Piling	1,000	Total tonnage reported	86,456
Potatoes	1,500		
Provisions	2,812	Estimated value	$1,636,930

W 2.

IMPROVEMENT OF WHITE RIVER, ARKANSAS.

OPERATIONS THIS FISCAL YEAR.

Operations were confined to the operation and maintenance of snag boats. The snag boat *Quapaw* worked over the river between Augusta (203) and Lock No. 2 (310) in July, between Augusta (203) and mouth of Black River (264) in November, and between Augusta (203) and Newport (258) during six days in December, and between Newport (258) and Lock No. 2 (310) in June. The *C. B. Reese* worked over the river from the mouth to Augusta (203) during October and November.

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Summary of work accomplished by snag boats Quapaw and C. B. Reese.

Boat.	Work done between—	Distance.	Snags removed.	Drifts broken.	Trees cut.	Miles run.
		Miles.				
Quapaw	Augusta and Lock No. 2	107	685	7	1,598	721
C. B. Reese	Mouth of river and Augusta	203	396	0	1,661	494
	Mouth of river and Lock No. 2	310	1,081	7	3,259	1,215

The balance available July 1, 1905, will be expended in operating and caring for snag boats.

The amount estimated as being needed for the fiscal year ending June 30, 1907, is for maintenance of channel by snagging operations.

Money statement.

July 1, 1904, balance unexpended	$10,372.66
Amount appropriated by river and harbor act approved March 3, 1905	15,000.00
	25,372.66
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	11,906.39
July 1, 1905, balance unexpended	13,466.27
July 1, 1905, outstanding liabilities	850.00
July 1, 1905, balance available	12,616.27
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	18,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

APPROPRIATIONS.

Appropriations for this river have been partly for limited reaches, partly for the whole river, and partly for this river in combination with others.

The appropriations for this river separately and for reaches of it are as follows:

June 23, 1874	$50,000.00	June 3, 1896	$22,000.00
August 14, 1876	10,000.00	March 3, 1899	14,815.00
March 3, 1879	10,000.00	June 13, 1902	22,000.00
June 14, 1880	20,000.00	May 31, 1904, allotted from appropriation for maintenance of river and harbor improvement, act of June 13, 1902	7,100.00
June 14, 1880	5,000.00		
March 3, 1881	8,000.00		
August 2, 1882	6,000.00		
August 2, 1882	4,000.00		
July 5, 1884	35,000.00	March 3, 1905	15,000.00
August 5, 1886	18,000.00		
August 11, 1888	25,000.00	Total	428,515.00
September 19, 1890	30,000.00	Expended to June 30, 1905	415,448.73
July 13, 1892	75,000.00		
August 18, 1894	52,000.00	Balance July 1, 1905	13,446.27

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COMMERCIAL STATISTICS.

No report was received of any steamboat commerce above Oil Trough, 13 miles above Jacksonport. Below Jacksonport the river was navigable all the year.

List of vessels that navigated White River, Arkansas, from May 31, 1904, to June 1, 1905.

Name.	Net tonnage.	Draft loaded. Steamer.	Draft loaded. Barges.	Between—	Round trips.	Passengers.
		Ft. in.	Ft. in.			
Cora Lee	30	1 8	3 0	Clarendon and Rosedale	19	51
Alda	75	2 0	5 0	Clarendon and Des Arc	10	.....
				Clarendon and St. Charles	10	.....
Bob West	3	1 8	.....	Augusta and Little Red River	5	.....
G. W. Huff	66	3 0	4 0	Jacksonport and Grand Glaize	21	54
Welcome	28	2 0	3 6	Jacksonport and Augusta	17	12
Monarch	43	3 6	4 0	Rosedale and Newport	4	.....
Little Abbey	4	2 0	2 0	Little and Black River	6	12
				Newport and Augusta	4	8
J. Taylor	15	1 0	1 6	Clarendon and Crocketts Bluff	52	.....
Evening Star	28	3 0	.....	Towing timber from lower river to Rosedale.	?	.....
				Newport and Oil Trough	4	.....
				Newport and Simmons Mill	1	.....
Gen. Joe Wheeler	65	3 0	3 0	Newport and Rosedale	2	.....
				Newport and Augusta	4	.....
				Newport and Clarendon	1	.....
				Newport and Des Arc	1	.....
Mildred	19	3 2	.....	Towing timber to Augusta	110	.....
Susan	198	4 6	5 0	Clarendon and Rosedale	3	307
Charle V	27	2 0	.....	Rosedale and St. Charles	17	.....
Peerless	13	1 8	3 6	Jacksonport and St. Charles	22	17
Hosmer	52	3 6	6 0	Mouth of river and Clarendon	1	.....
F. W. Tucker	99	4 0	4 0	Black River and Newport	50	35
				Newport and Augusta	10	2
Geo. Pope	62	3 0	4 0	Black River and Newport	40	10
				Newport and Augusta	10	.....
J. B. Galloway	37	3 0	5 0	Towing timber to Clarendon	?	.....
Minnehaha	46	2 5	5 0			
Myrtle Corey	9	2 0	.....	Cotter to mouth of river	1	.....
Grace Smith	66	3 6	6 0	Maddox Bay and Augusta	29	.....

Classification of commerce reported year ending May 31, 1905.

Articles.	Quantity.	Articles.	Quantity.
	Tons.		Tons.
Cotton	1,329	Staves and bolts	1,293
Cotton seed	824	Miscellaneous freights	891
Lumber	8,630		
Railway ties	41,085	Total	131,938
Saw logs	76,502		
Mussel shells	1,434	Estimated value	$676,989

W 3.

IMPROVEMENT OF UPPER WHITE RIVER, ARKANSAS.

OPERATIONS THIS FISCAL YEAR.

Lock and Dam No. 1.—The only work done here under this appropriation during this fiscal year was the rebacking of the dam. This was done in conjunction with the repairs made out of the "operating and care fund" in December, 1904, the cost of the work being borne by both appropriations.

Lock and Dam No. 2.—The construction work built here this fiscal year was as follows: Four hundred and eight linear feet of dam (aver-

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age height 29 feet); 1 Cail fishway, 303 feet from lock wall; 1 corner crib, 25 by 35 feet, adjacent to the lock wall; 2 protection mattresses along the 205 feet of dam built in previous years and founded on piles; the lower land crib to the lock; the lower river crib up to 5 feet above lower pool; one 150-foot protection crib below abutment; 50 linear feet of revetment below this protection crib; abutment and timber extension raised 4 feet, making its height 14 feet above crest of dam; new shafts and gear placed on emptying valves of the lock; some minor work done around the lock house; ordinary repairs made to the fleet, and some high-water damages repaired. This last-mentioned work was done in connection with repairs made from the "operating and care fund."

The following extract from report of Mr. William Parkin, assistant engineer in local charge of this work, gives detailed information concerning the most important of the work done at Lock No. 2 during this fiscal year:

Section of dam on rock.—* * * The balance of the dam, 408 feet, is founded on rock or on bowlders close to bed rock, and was built this year. * * * First section, 100 feet long, was placed against lock wall September 3; second section, 140 feet long, against the portion of the dam built in previous years, on September 17; third section 100 feet long, was swung into position on lock side, October 4, and the closing one, 58 feet long, October 14. Sheeting and filling completed November 16; the decking on the 17th, and the pool overflowed the dam on the night of the 18th. Back filling of the dam was started October 25 and completed November 29, but the covering of the backing with riprap was not finished until January 6 * * *.

Corner crib.—This crib is 20 by 35 feet in plan, set in the angle made by the dam and lock wall. It connects with the old cofferdam, is filled with riprap and further protected by derrick stone, which extends along the lock wall at an elevation of about 1 foot below the apron of the dam. This work was done between November 17 and December 5.

Protection to 250-foot section of dam on piles.—This work was the placing of a mattress 35 feet wide on the backing above the dam and paving it with stone; the laying of a mattress of same width below the dam and covering that with derrick stone. The last stone was placed December 31.

* * * * * * *

Lower river crib.—* * * Although built with a batter on the pit face of one-fourth inch in 10 inches, the crib settled so badly toward the pit that it was torn down to a little above lower pool level early in May and has not yet been rebuilt.

* * * * * * *

Temporary buildings.—In April and May all but one of these buildings were torn down and removed to Lock No. 3.

Enlargement of abutment.—The enlargement work was that of raising the concrete stem, its timber extension, and back fill, 4 feet; the laying and paving of a mattress around the foot of back fill above the abutment and the reenforcing of the work at the points most exposed to attack with derrick stone. Work was begun July 1, and with the exception of the paving and derrick stone, was completed July 30. The last derrick stone was placed December 31.

Damage by high water.—Each of several freshets from March to June damaged the work more or less, and since June 1 repairs to the injured work has been in progress with all available men and floating plant.

The first few spring rises merely caused slight settlement in the stone protection above and below the abutment, and necessitated the construction of 50 linear feet of revetment at the lower end of the abutment protection crib, all of which was done by the middle of May. In the latter part of May, however, the river rose 3 feet over the lock walls, which was 13 feet on the dam and to within 1 foot of the top of the abutment. Above the abutment and the portion of the dam on piles much of the backing was washed away, some of the scour being 21 feet below crest of dam. Most of the damage was confined to the work around the upper end of the abutment and the first hundred feet of the backing of the dam. On the lower side of the dam serious scour occurred at the downstream end of abutment, along the face of the

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150-foot protection crib and along the face of the dam on piles for a distance of 120 feet out from the abutment. * * *

On June 17 at 3 p. m., just as the repairs above the abutment were completed, the back fill above the abutment began to settle rapidly at the river end. * * * By night the leak had extended back along the stem 50 feet and the bottom was somewhere below upper pool level. At 10.30 p. m., by the use of brush and stone, the caving was stopped and the leak greatly reduced. Gravel, mud, riprap, and derrick stone were used in rebuilding this backing, but the leak has not stopped entirely. The repairs above the abutment are practically completed, but below the dam and abutment the repairs are only about one-half finished, and the work is thought to be safe for at least 10 feet on the dam.

Up to and including June 15 these repairs were paid for from "construction funds," and since that date from funds for operation and care.

Lock and Dam No. 2 was turned over to "operating and care" on February 16, 1905.

Lock and Dam No. 3.—Actual work on this lock was begun April 13, 1905, when the U. S. towboat *Cleveland* with two barges loaded with lumber from the old quarters buildings at Locks 1 and 2, left Lock 2 for Lock 3. Camp was made at Lock No. 3 the next day, and construction of temporary buildings began April 17. Since that date the temporary buildings proper have all been erected, and also the following structures, viz, unloading platform for lumber, 348 by 20 feet; cement shed of 4,000 barrel capacity, and a tramway from lumber yard to lock site. The stone bin and concrete mixer are being erected, and a telephone line from Batesville is under construction. Timber for the cofferdam, lock forms, etc., is being received.

Recommendation regarding future operations.—Pending the action of the Board of Engineers appointed to pass upon the worthiness of this improvement, I have no recommendation to make other than that $57,410 be provided for in the next river and harbor bill to complete Lock and Dam No. 3.

The original estimate for this work is given in Annual Report for 1897, page 1993. It is evidently too low, and the underestimate appears to be principally in the estimate for the abutments and the dam. The cost of one abutment is given as $5,000. The concrete alone in one abutment will cost more than that; the necessary excavation, refilling, stone covering, and additional protection to the banks adjacent to the abutment, easily runs the cost up to thirty and thirty-five thousand dollars. One dam is estimated at $42,000; the dimensions of the dam are not given, but as the average low-water width of the river is given as about 600 feet, it is not probable that a less length was intended for the dam. If that was the length estimated on, the unit price for the estimate will be $70 a linear foot. This is not enough for a dam as heavy as needed in this river. Dam No. 3 is to be built in a favorable location and on a shallow foundation. Its estimated cost is $67,635. These two items alone make a shortage of over $53,000 in the estimate. Locks and Dams Nos. 1 and 2 cost $580,000, being an average of $290,000 a lock and dam. Lock and Dam No. 3 is estimated to cost $217,410. It is not probable that any of the other locks and dams will cost much less than No. 3, and one or two of them may run up to $260,000.

The balance now available will be expended in completing Lock and Dam No. 2, and in building the lock and the abutment at Lock and Dam No. 3.

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Money statement.

July 1, 1904, balance unexpended		$65,494.17
Amount appropriated by river and harbor act approved March 3, 1905		160,000.00
		225,494.17
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$71,649.53	
Less sales	208.28	
		[a] 71,441.25
July 1, 1905, balance unexpended		154,052.92
July 1, 1905, outstanding liabilities		8,168.43
July 1, 1905, balance available		145,884.49
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905		57,410.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.		

APPROPRIATIONS.

March 3, 1899	$160,000.00
June 6, 1900	150,000.00
June 13, 1902	270,000.00
March 3, 1905	160,000.00
Total	740,000.00
Expended to June 30, 1905	585,947.08
Unexpended July 1, 1905	154,052.92

EMERGENCY CONTRACTS IN FORCE.

Name and address of contractor.	Nature of contract.	Unit rate.	Contract approved.	Work began.	Expiration of contract.
R. W. Earnheart, Batesville, Ark.	2,000 cubic yards stone	$0.73	Aug. 4, 1904	Aug. 6, 1904	Oct. 5, 1904
	Any sound timber, as follows:				
	12,800 feet B. M	9.00			
	42,000 feet B. M	10.00			
	92,900 feet B. M	12.00			
	10,208 feet B. M	14.00			
	3,040 feet B. M. oak lumber.	15.00			
Jas. G. Clark, Beirne, Ark.	Pine lumber, as follows:				
	20,762½ feet B. M	9.50	Apr. 21, 1905	Apr. 27, 1905	June 25, 1905
	8,288 feet B. M	10.00			
	22,020 feet B. M	11.00			
	6,400 feet B. M	12.00			
	9,108 feet B. M	12.50			
	84,600 feet B. M	13.00			
	3,000 feet B. M	13.50			
	28,560 feet B. M	14.00			
	2,566½ feet B. M	14.50			

COMMERCIAL STATISTICS, YEAR ENDING MAY 31, 1905.

The only steamboat reporting having navigated this river during this year was the steamer *Myrtle Corey*, which made a single trip from Cotter, Ark., to the mouth of White River. She carried no freight. The rafted commerce for the year was 12,496 tons of railway ties, having an estimated value of $42,736.

[a] Lock No. 1, $1,117.80; Lock No. 2, $59,428.10; Lock No. 3, $10,895.35.

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W 4.

OPERATING AND CARE OF LOCKS AND DAMS NOS. 1 AND 2, UPPER WHITE RIVER, ARKANSAS.

These locks and dams were built from funds derived from appropriations for improving Upper White River, Arkansas. Lock No. 1, 1 mile below Batesville, Ark., was placed under the indefinite appropriation for operating and care of canals, etc., January 16, 1904; Lock No. 2, 8 miles above Batesville, Ark., was placed under that appropriation February 16, 1905.

OPERATIONS THIS FISCAL YEAR.

Lock and Dam No. 1.—During November the lower approach to the lock was redredged. In December the dam was rebacked, in which work 1,200 cubic yards of puddle, 2,400 cubic yards of gravel, and 781 cubic yards of riprap stone were used. Also in December a Cail fishway was placed in the dam, 37 feet from the abutment. During the spring months, the old quarters houses used during the construction of the lock and dam were torn down and sent to Lock No. 3; 1,500 feet of driveway was graded and graveled, and the riprap covering to the bank below the abutment taken up and relaid. This latter work was necessitated by the covering having become gullied through surface wash.

Lock and Dam No. 2.—Freshets in May did considerable damage to the bank protection adjacent to the abutment; washed out a large amount of the backing above the dam; caused the protection mattress below the section of the dam on piles to settle from 7 to 17 feet over a distance of 120 feet from the abutment, and caused a like settlement of the stone filling in the apron cribs. Repairs were begun just as soon the stage of river permitted any work being done there. On June 17, just as the repairs to shore protection above the abutment were completed, a serious leak developed under the abutment. By a liberal use of brush and stone the leak was gotten under control that night. The next day the dredge and practically all the working force from Lock No. 3 were taken to this place and began the refilling of the areas that subsided through the effects of the leak. Repairs are still in progress. Up to the close of the fiscal year 1,436 cubic yards of riprap, 516 cubic yards of gravel, 316 cubic yards of derrick stone, and 90 cubic yards of puddle have been used in these repairs.

Allotments.

December 26, 1903, Lock and Dam No. 1		$600.00
June 22, 1904, Lock and Dam No. 1		3,701.00
February 10, 1905, Lock and Dam No. 2		1,095.00
June 28, 1905, Lock and Dam No. 2		4,850.00
Total		10,246.00
Expended to June 30, 1905	$5,011.86	
Outstanding liabilities, July 1, 1905	3,820.44	
		8,832.30
Available July 1, 1905		1,413.70

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Summary of expenditures during the fiscal year ending June 30, 1905.

Nature.	Lock and Dam No. 1.	Lock and Dam No. 2.	Total.
Services	$2,648.27	$811.33	$3,459.60
Materials	422.18	42.00	464.18
Supplies	402.49	156.54	559.03
Property	15.77	32.30	48.07
General expense	91.30	27.82	119.12
Total	3,580.01	1,069.99	4,650.00

COMMERCIAL STATISTICS, YEAR ENDING MAY 31, 1905.

	Lock and Dam No. 1.	Lock and Dam No. 2.[a]
Lockages.....number..	244	60
Steamboats.....do....	1	1
Houseboats.....do....	19	2
Small crafts.....do....	44	.....
Railway ties, rafted.....tons..	8,771	4,103

[a] Three and one-half months.

W 5.

IMPROVEMENT OF CACHE RIVER, ARKANSAS.

OPERATIONS THIS FISCAL YEAR.

Nothing done, there being no funds available until the low-water season, which is the snagging season, had passed. The funds now available will be expended during the months of September and October, 1905, in snagging operations.

The amount estimated as being needed during the fiscal year ending June 30, 1907, is for snagging operations between James Ferry and the mouth of the river.

Money statement.

July 1, 1904, balance unexpended	$10.00
Amount appropriated by river and harbor act approved March 3, 1905	2,000.00
July 1, 1905, balance unexpended	2,010.00
July 1, 1905, outstanding liabilities	10.00
July 1, 1905, balance available	2,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	2,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

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APPROPRIATIONS AND ALLOTMENTS.

August 11, 1888, mouth to Riverside	$7,000
July 13, 1892, mouth to Riverside	2,000
August 17, 1894, allotted from White River	2,000
June 3, 1896, allotted from White River	2,000
March 3, 1899, mouth to James Ferry	1,000
June 13, 1902, mouth to James Ferry	2,000
March 3, 1905, mouth to James Ferry	2,000
Total	18,000
Expended to June 30, 1905	15,990
Unexpended July 1, 1905	2,010

COMMERCIAL STATISTICS.

The commerce reported for the year ending June 1, 1905, consisted of 7,300 tons of saw logs and 4,360 tons of railway ties, having a total estimated value of $29,860. The steamer *Grace Smith* was the only boat that reported navigating the river during the year. This boat made three trips to tie camps.

W 6.

IMPROVEMENT OF BLACK AND CURRENT RIVERS, ARKANSAS AND MISSOURI.

Heretofore the improvement of Black River and of Current River have been separate works. They were consolidated by the river and harbor act of March 3, 1905.

OPERATIONS THIS FISCAL YEAR.

(*a*) *Current River.*—Only one snag boat, the *Quapaw*, was available for work on this stream this year, the other boat, the *Riverside*, being rebuilding during the snagging season. The fund available was only sufficient to work the *Quapaw* five weeks, four of these being the month of September, the other being one week in December. Four hundred and fifty-five snags were removed, 451 trees cut, and 5 drifts broken between the mouth of the river and Little Black River, 32 miles. The minimum channel depth up to White Horse shoal, which is about one-fourth mile below the mouth of Little Black River, was 3½ feet. At White Horse shoal it was 30 inches.

(*b*) *Black River.*—The snag boat *Quapaw* worked over the river below the mouth of Current River (116 miles) in August, October, and eight days in December. The minimum channel depth was 3 feet at Julia Dean shoal.

The construction of the new hull for the snag boat *Riverside* was begun September 5. The hull was launched October 22 and the boat completed November 16. The boat began snagging operations at Poplar Bluff the next day. It worked down the river as far as Caney Slough, 26 miles, where work was suspended on January 9 because of lack of funds. The minimum channel depth was 2 feet. From Caney Slough the boat returned to Poplar Bluff and lay up, pending the

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action of Congress on a river and harbor bill. It resumed work at Poplar Bluff June 3, and to the close of the year has worked down the river to Little Hunting Slough, 39 miles.

Summary of work done by the snag boats Quapaw and Riverside.

Boat.	Work done between—	Distance.	Snags removed.	Drifts broken.	Trees cut.	Miles run.
		Miles.				
Quapaw	Mouth of Black and mouth of Current rivers.	116	764	7	991	536
Riverside	Poplar Bluff and Little Hunting Slough.	39	645	3	841	119
Totals		155	1,409	10	1,832	655

The available balance will be expended in snagging operations.

The amount estimated as being needed for the fiscal year ending June 30, 1907, is for snagging operations, which are needed for maintenance of channel.

Money statements.

BLACK RIVER.

July 1, 1904, balance unexpended		$10,268.31
Amount appropriated by river and harbor act approved March 3, 1905		13,000.00
		23,268.31
June 30, 1905, amount expended during fiscal year:		
For maintenance of improvement	$9,773.76	
Less sales	85.00	
	9,688.76	
Deposited to credit of Treasurer of United States	319.50	
		10,008.26
July 1, 1905, balance unexpended		13,260.05
July 1, 1905, outstanding liabilities		275.00
July 1, 1905, balance available		12,985.05
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		15,600.00

CURRENT RIVER.

July 1, 1904, balance unexpended		$3,220.16
Amount appropriated by river and harbor act approved March 3, 1905		5,000.00
		8,220.16
June 30, 1905, amount expended during fiscal year, for maintenance of improvement		3,141.62
July 1, 1905, balance unexpended		5,078.54
July 1, 1905, outstanding liabilities		23.00
July 1, 1905, balance available		5,055.54
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		6,000.00

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APPROPRIATIONS.

Appropriations for Black River have been made separately under the heads of "Improving Black River, Missouri," "Improving Black River, Arkansas," and "Improving Black River, Arkansas and Missouri." This river is understood not to have been included in the snagging operations under the early appropriations for snagging in western rivers. The appropriations for it and for Current River are:

Act.	Black River.	Current River.
June 2, 1872		$5,000.00
June 14, 1880	$15,000.00	
March 3, 1881	6,000.00	2,000.00
August 2, 1882	10,000.00	
July 5, 1884	20,000.00	
August 5, 1886	5,000.00	
August 11, 1888	12,000.00	
September 19, 1890	12,000.00	
July 13, 1892	5,000.00	
August 15, 1894	9,500.00	8,000.00
June 3, 1896	8,000.00	2,000.00
March 3, 1899	8,000.00	5,000.00
June 13, 1902	21,700.00	6,900.00
May 31, 1904, allotted from maintenance appropriation, act of June 13, 1902	[a] 8,530.50	2,935.00
March 3, 1905 (apportioned)	13,000.00	5,000.00
Total	158,730.50	36,835.00
Expended to June 30, 1905	140,470.45	31,756.46
Unexpended July 1, 1905	18,260.05	5,078.54

[a] $8,850 less $319.50, not used and returned to Treasury.

COMMERCIAL STATISTICS.

List of vessels that navigated Black River from May 31, 1904, to June 1, 1905.

Name.	Net tonnage.	Draft loaded. Steamer.	Draft loaded. Barges.	Between—	Round trips.	Passengers.
		Ft. in.	Ft. in.			
C. E. Taylor	50	3 6	4 0	Pocahontas and Biggers	4	
				Pocahontas and Strawberry	10	
F. W. Tucker	99	4 0	4 0	Black Rock and Newport	50	35
Geo. Pope	62	3 0	4 0	Pocahontas and Biggers	3	
				Pocahontas and Newport	40	10
Krata	80	3 0	4 0	Black Rock and Strawberry	2	
				Pocahontas and Johnsons	40	
Alma Jane	24	2 0	2 6	Poplar Bluff and Pocahontas	1	
				Poplar Bluff and Carolla	61	
Roy	24	2 0	2 6	Poplar Bluff and Old River	120	9
G. W. Huff	66	3 0	4 0	Mouth of Current and mouth of Black	65	210
Welcome	28	2 0	3 6	Jacksonport and Black Rock	48	27
Peerless	13	1 8	3 6	Newport and Black Rock	3	

List of vessels that navigated Current River from May 31, 1904, to June 1, 1905.

Name.	Net tonnage.	Draft loaded. Steamer.	Draft loaded. Barges.	Between—	Round trips.	Passengers.
		Ft. in.	Ft. in.			
Alma Jane	24	2 0	2 6	Pocahontas and Johnsons	40	
C. E. Taylor	50	3 6	4 0	Pocahontas and Biggers	4	
Geo. Pope	62	3 0	4 0	do	3	
G. W. Huff	66	3 0	4 0	Duffs Ferry and mouth of river	29	182

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Classification of commerce reported, year ending May 31, 1905.

Articles.	Black River.	Current River.	Article.	Black River.	Current River.
	Tons.	*Tons.*		*Tons.*	*Tons.*
Cotton	395	.....	Railway ties	44,191	12,916
Cotton seed	453	.....	Rough spokes	2,000	.....
Staves and bolts	12,690	2,585	Miscellaneous freights	2,295	500
Lumber	22,552	.....			
Provisions	1,365	1,005	Total	144,065	74,048
Piling	10,365	80			
Saw logs	47,759	57,012	Estimated value	$1,004,299	$409,297

W 7.

IMPROVEMENT OF ST. FRANCIS AND L'ANGUILLE RIVERS, ARKANSAS.

OPERATIONS THIS FISCAL YEAR.

The construction of a new hull for the snag boat *A. B. Johnson* was begun August 20. The hull was launched October 1, and the rebuilding of the boat was completed October 22. Snagging operations were begun at Madison on October 28. From Madison the boat worked down to Black Fish Cut-off, 27 miles, then back upstream to Anderson Bend, 19 miles above Madison. Work was suspended at Anderson Bend January 10, and the boat returned to Madison and laid up. Three hundred and forty-three snags were removed and 661 trees cut in the 46 miles of river worked over by the boat. The minimum channel depth encountered was 14 inches on Crow Creek and Jarvis shoals.

The estimate for the improvement of St. Francis River, Arkansas, is $8,000 annually. The improvement of L'Anguille River from its mouth to Marianna was added to the St. Francis River improvement by the river and harbor act of June 13, 1903, and an appropriation of $9,000 was made for the two streams. A like amount will be needed in the fiscal year ending June 30, 1907.

Money statement.

July 1, 1904, balance unexpended		$4,937.22
Amount appropriated by river and harbor act approved March 3, 1905.		6,000.00
		10,937.22
June 30, 1905, amount expended during fiscal year:		
For maintenance of improvement	$4,637.13	
Less sales	10.00	
	4,627.13	
Deposited to credit of Treasurer of United States	62.81	
		4,689.94
July 1, 1905, balance unexpended		6,247.28
July 1, 1905, outstanding liabilities		460.00
July 1, 1905, balance available		5,787.28
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905		9,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

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APPROPRIATIONS.

The earlier examinations and the earlier operations were made under appropriations for these in conjunction with other rivers. Of the expenditures under those appropriations this office has no record.

The separate appropriations are as follows:

March 3, 1871, St. Francis River, Arkansas	$10,000.00
June 14, 1880, St. Francis River, Arkansas	5,000.00
Juiy 5, 1884, St. Francis River, Arkansas	12,000.00
August 5, 1886, St. Francis River, Arkansas	8,000.00
August 11, 1888, St. Francis River, Arkansas	4,000.00
September 19, 1890, St. Francis River, Arkansas	4,000.00
August 18, 1894, St. Francis River, Arkansas (part)	8,000.00
June 3, 1896, St. Francis River, Arkansas	8,000.00
March 3, 1899, St. Francis River, Arkansas	8,000.00
June 18, 1878, L'Anguille River, Arkansas	10,000.00
March 3, 1879, L'Anguille River, Arkansas	5,000.00
June 14, 1880, L'Anguille River, Arkansas	2,000.00
June 13, 1902, St. Francis and L'Anguille rivers, Arkansas	9,000.00
May 31, 1904, allotted from appropriation for maintenance of river and harbor improvement, act June 13, 1902 (less $62.81 returned)	4,237.19
March 3, 1905	6,000.00
Total for St. Francis and L'Anguille rivers, Arkansas	103,237.19
Expended to June 30, 1905:	
Old projects $84,000.00	
New project 12,989.91	
	96,989.91
Unexpended July 1, 1905	6,247.28

COMMERCIAL STATISTICS.

The river was too low for navigation from September, 1904, to February, 1905. Full report of steamboat commerce was not received.

List of vessels that navigated St. Francis River, Arkansas, from May 31, 1904, to June 1, 1905.

Name.	Net tonnage.	Draft loaded. Steamer.	Draft loaded. Barges.	Between—	Round trips.	Passengers.
		Ft. in.	*Ft. in.*			
Hazel Rice	138	3 6	6 0	Helena and Westwood	8	.....
Mary F. Carter	48	2 6	6 0	Helena and Wittsburg, Neeleys Ferry and intermediate points.	46	.....
C. F. Drewes	5	2 0	1 6	Madison and Sand Slough	2	.....
Hosmar	52	3 6	6 0	Helena and Madison	2	.....
Lake City	17	10	2 0	Lake City and Marked Tree	43	219
J. B. Butts	12	2 6	2 0	Helena and Ashworth	52	200
Maud Killgore	82	3 6	5 6	Helena and Madison	2	.....

Classification of commerce reported year ending May 31, 1905.

Articles.	Quantity.	Articles.	Quantity.
	Tons.		*Tons.*
Cotton	802	Railway ties	2,050
Cotton seed	2,530	Miscellaneous freights	819
Grain	310		
Lumber	520	Total	96,854
Provisions	739		
Saw logs	89,084	Estimated value	$497,305

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W 8.

IMPROVEMENT OF ST. FRANCIS RIVER, MISSOURI.

OPERATIONS THIS FISCAL YEAR.

Nothing done this fiscal year. Acting under authority granted by the Secretary of War, the movable property used on this work was shipped to Batesville, Ark., and the snagging barge and scows sold at auction late in the last fiscal year. The balance remaining on hand at the close of that year was expended in paying the expenses connected with this and in paying some other outstanding liabilities.

No further work is contemplated in view of the provision in section 7 of the river and harbor act of March 3, 1905, repealing the provisions of previous acts providing for improvement of this stream.

Money statement.

July 1, 1904, balance unexpended	$174.40
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	174.40.

APPROPRIATIONS.

This reach of river is understood not to have been included in the snagging operations under the early appropriations for snagging in western rivers. Its specific appropriations are as follows:

August 11, 1888	$5,000.00
September 19, 1890	10,500.00
August 18, 1894	5,000.00
June 13, 1902	10,000.00
Total	30,500.00
Expended to June 30, 1905	30,500.00

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APPENDIX X.

REMOVING SNAGS AND WRECKS FROM MISSISSIPPI RIVER; IMPROVEMENT OF MISSISSIPPI RIVER BETWEEN THE OHIO AND MISSOURI RIVERS.

REPORT OF MAJ. THOS. L. CASEY, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1905, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Removing snags and wrecks from the Mississippi River below the mouth of the Missouri River.
2. Mississippi River between the Ohio and Missouri rivers.

ENGINEER OFFICE, UNITED STATES ARMY,
St. Louis, Mo., July 18, 1905.

GENERAL: I have the honor to transmit herewith the annual report for the works under my charge for the fiscal year ending June 30, 1905.

Very respectfully, your obedient servant,

THOS. L. CASEY,
Major, Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

X 1.

REMOVING SNAGS AND WRECKS FROM THE MISSISSIPPI RIVER BELOW THE MOUTH OF THE MISSOURI RIVER.

A concise statement of the project for, and history of, this work will be found in the Annual Report of the Chief of Engineers, United States Army, to which this is an appendix, as well as on page 2621 of the Report of the Chief of Engineers, United States Army, for 1900.

This work is now being done through the instrumentality of two large steel-hulled snag boats—*H. G. Wright* and *J. N. Macomb*—fitted with all necessary tools and appliances and operated by hired men. They patrol the river between the mouth of the Missouri River and Natchez, Miss., going occasionally as far down as New Orleans, La.

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OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1905.

During the year the snag boats patrolled the parts of the river assigned to them—the *H. G. Wright* between the mouth of the Missouri River and Memphis, Tenn., and the *J. N. Macomb* between Memphis, Tenn., and Natchez, Miss.—and removed snags, wrecks, drift piles, and leaning trees wherever required, until the spring rise of the river, about the middle of March, 1905, when they were laid up with reduced crews for the ordinary annual repairs, the *Wright* at St. Louis, Mo., and the *Macomb* at Memphis, Tenn. The boats remained at the respective places until the end of the fiscal year, continuing repairs and awaiting a stage of the river favorable for their operations.

A summary of the work accomplished by the two boats during the year is found in the following table:

Name.	Snags pulled.	Trees cut.	Drift piles removed.	Miles run.
J. N. Macomb	2,597	5,875	16	6,880
H. G. Wright	1,521	9,366	3	6,591
Total	4,118	15,241	19	13,471

In addition to the above the *Wright*, on October 4–5, 1904, removed a rock obstruction at Birdpoint, Mo.; October 21, 1904, broke up wreck of coal barge at Island No. 21; October 26, 1904, removed wreck of steamer *Jim Lee*, in Hopefield Bend; November 23 to December 17, 1904, removed wreck of transfer steamer *Junius S. Morgan*, at Cairo, Ill.; December 22–23, 1904, worked on wreck of steamer *Robert E. Lee*, at Craighead, 68 miles below Caruthersville, Mo.; December 31, 1904, assisted in rescuing a derrick boat and three barges at Island No. 21; March 8 and 20–23, 1905, removed sunken derrick boat opposite Grand Tower, Ill. On October 17, 1904, the *Macomb* worked at removal of old wreck at Hopefield Bend; October 18, 1904, worked on sunken barge loaded with stone near the bridge at Memphis, Tenn.; December 17, 1904, removed remaining parts of wreck of steamer *Emma Etheridge*, at Greenville, Miss., upon which work was discontinued on account of a sudden rise of the river on January 17, 1904.

The trees referred to are generally leaning timber in bends of the river or trees that are liable to fall into the water and become obstructions to navigation.

APPROPRIATIONS.

The appropriations from the beginning of the work to the year 1878 were made in lump sums, principally under the titles of "Improvement of the Mississippi, Missouri, and Arkansas rivers," and were applied to those streams as their needs or the terms of the laws required. Appropriations from March 3, 1879, to August 5, 1886, were specifically made or allotted for this work.

An annual appropriation of an amount not to exceed $100,000 having been made for this work by the act of August 11, 1888, the snag boats will patrol the river whenever necessary in order to keep the channel free from obstructions, such as logs, drift jams, leaning trees, and such wrecks as they may be able with their appliances to remove after the same have been blown to pieces with explosives.

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EXPENDITURES.

The amount expended previous to June 30, 1872, can not now be approximately ascertained, for the reason that the available published information for that period does not state the amounts expended either for each stream or collectively for all the streams upon which work was done.

The approximate amount expended from July 1, 1872, to June 30, 1880, was $493,437.23, which amount was arrived at by dividing the total amount expended each year on all the rivers upon which work was done by the total number of snags pulled each year, as ascertained from available published information, and applying this average cost per snag to those removed from the Mississippi River.

The exact amount expended from July 1, 1880, to June 30, 1905, was $1,834,735.52, making a total of approximated and definitely known expenditures from July 1, 1872, to the present date, $2,328,172.75, the details of which are shown in the following table:

Table of amount expended and work done in removing obstructions in Mississippi River between mouth of Missouri River and New Orleans, La., from March 28, 1868, to June 30, 1905.

Year.	Amount expended.	Work done.			
		Snags pulled.	Trees cut.	Drift piles removed.	Wrecks removed.
March 28, 1868, to June 30, 1871		3,271	37,438	30	
Fiscal year ending June 30—					
1872		1,365	2,621	12	
1873	$46,901.40	1,365	1,713	5	
1874	72,802.80	630	515	6	
1875	70,727.01	1,461	2,984	14	
1876	49,854.30	1,213	1,589	5	1
1877	36,220.08	676	403	4	
1878	20,122.54	889	3,346	1	
1879	121,820.16	1,133	2,690	5	
1880	74,988.94	1,522	60	19	
1881	102,308.43	1,057	647	6	
1882	75,311.29	1,909	4,983	32	
1883	69,540.59	2,775	26,297	34	
1884	18,390.48	958	4	3	
1885	45,395.47	1,692	16,900		
1886	20,047.71	693	567		
1887	43,583.12	2,030	5,269	10	
1888	17,302.29	798	348		
1889	67,511.37	1,864	9,102	34	8
1890	49,089.17	2,861	12,112	23	1
1891	92,720.97	3,450	21,316	37	
1892	98,250.00	3,389	20,571		
1893	96,497.23	2,946	8,214	16	
1894	88,252.46	3,057	22,861	19	5
1895	100,000.00	3,307	17,520	22	3
1896	80,496.26	2,979	19,648	11	1
1897	83,421.64	3,072	31,014	24	2
1898	88,917.74	4,253	14,856	32	3
1899	88,923.15	3,300	30,695	34	
1900	86,355.29	4,479	15,170	19	
1901	86,710.05	3,566	19,746	28	
1902	93,055.27	3,907	28,870	27	7
1903	72,587.48	1,552	6,895	2	
1904	88,245.25	4,654	17,034	18	2
1905	81,822.81	4,118	15,241	19	12
Total	2,328,172.75	82,191	419,289	551	45

Amount expended from current allotment during the fiscal year, $81,822.81. A statement of this expenditure, as required by law, is given in the accompanying table.

The work done by the snag boats is of great benefit to the commerce and navigation on the river. Before the river was so completely

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patrolled as it now is the sinking of steamboats and other river craft by running on snags was a common occurrence. During recent years such disasters seldom occur. Although life and property would seem to be much safer now than formerly, the rate of insurance has not materially decreased.

It is proposed during the coming year to continue operating these snag boats, as provided in the river and harbor act of August 11, 1888.

The statistics relating to the commerce benefited by the operation of these snag boats will be found in the report of operations for this year for the improvement of the Mississippi River from the mouth of the Missouri to the mouth of the Ohio River.

The headquarters of the snag boats is in St. Louis.

The amount of customs collected at St. Louis during the fiscal year was $2,402,820.53.

The amount of internal revenue collected was $7,525,780.18.

Money statement.

Amount drawn under section 7, act of August 11, 1888	$81,822.81
June 30, 1905, amount expended during fiscal year	81,822.81
July 1, 1905, amount available for fiscal year 1905–6	100,000.00

ALLOTMENTS.

Previous to March 3, 1879 (approximated)	$358,627.35	Fiscal year ending June 30—	
By act of—		1894	$88,252.46
March 3, 1879	100,000.00	1895	100,000.00
June 14, 1880	100,000.00	1896	80,496.26
March 3, 1881	80,000.00	1897	83,421.64
March 2, 1882	85,000.00	1898	88,917.74
July 5, 1884	72,950.63	1899	88,923.15
August 5, 1886	56,250.00	1900	86,355.29
August 11, 1888	100,000.00	1901	86,710.05
Fiscal year ending June 30—		1902	93,055.27
1890	49,089.17	1903	72,587.48
1891	92,720.97	1904	88,245.25
1892	98,250.00	1905	81,822.81
1893	96,497.23	Total	2,328,172.75

TABLE No. 1.—*Summary of expenses for operating U. S. snag boats H. G. Wright and J. N. Macomb in connection with the work of removing obstructions in Mississippi River during the fiscal year ending June 30, 1905.*

Application.	1904.				
	July.	August.	September.	October.	November.
Office expenses	$1.20	$3.61	$935.65	$2.55	$6.10
Expenses of snag boat H. G. Wright:					
Crew	1,606.00	2,096.00	2,085.28	2,079.84	2,120.75
Outfit	12.50	.....	.....	31.52	23.60
Fuel	330.66	1,063.65	728.78	875.85	754.06
Subsistence	529.25	276.45	545.00	346.10	416.41
Supplies	4.48	.....	.....	.....	41.25
Repairs	.....	.....	7.76	5.60	.....
Expenses of snag boat J. N. Macomb:					
Crew	1,506.17	2,005.00	2,085.00	2,120.00	2,096.67
Outfit	.....	.....	.....	76.52	.....
Fuel	483.50	1,352.54	1,070.84	1,408.25	1,120.75
Subsistence	456.75	460.62	462.87	443.63	573.87
Repairs	.....	.....	.....	107.35	.....
Total	4,930.51	7,257.87	7,921.18	7,497.21	7,153.49

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TABLE No. 1.—*Summary of expenses for operating U. S. snag boats H. G. Wright and J. N. Macomb*—Continued.

Application.	1904.	1905.			
	December.	January.	February.	March.	April.
Office expenses	$810.07	$10.60	$784.80	$2.40	.....
Expenses of snag boat H. G. Wright:					
Crew	2,125.00	2,100.06	2,118.00	2,118.50	$1,465.00
Outfit	.....	.....	.....	.....	769.53
Fuel	862.50	814.95	496.90	404.55	407.00
Subsistence	393.82	497.18	463.07	507.11	74.47
Supplies	.....	.....	.....	.....	632.56
Repairs	76.97	.....	.....	.....	1,228.00
Miscellaneous	.....	4.90	.....	.....	.....
Expenses of snag boat J. N. Macomb:					
Crew	2,077.16	2,081.00	2,018.66	1,797.34	1,358.50
Outfit	.....	.....	.....	.....	636.33
Fuel	1,051.25	924.55	768.54	640.50	204.00
Subsistence	581.10	188.91	793.23	150.66	225.77
Supplies	.....	.....	32.01	.....	262.33
Repairs	.....	.....	116.46	.....	831.28
Total	7,917.87	6,622.15	7,590.17	5,621.06	8,095.77

Application.	1905.		
	May.	June.	Total.
Office expenses	$782.50	.....	$3,338.96
Expenses of snag boat H. G. Wright:			
Crew	1,454.00	$1,455.00	22,823.43
Outfit	387.45	43.32	1,217.92
Fuel	130.40	118.80	6,977.10
Subsistence	290.85	252.79	4,519.33
Supplies	134.71	22.84	835.84
Repairs	898.14	380.55	2,597.02
Miscellaneous	.....	.....	4.90
Expenses of snag boat J. N. Macomb:			
Crew	1,398.83	1,480.00	22,024.33
Outfit	213.80	22.50	949.15
Fuel	158.00	158.00	9,340.72
Subsistence	272.61	237.55	4,797.57
Supplies	63.03	.....	357.87
Repairs	464.80	505.56	2,025.45
Total	6,588.62	4,676.91	81,822.81

X 2.

IMPROVEMENT OF MISSISSIPPI RIVER BETWEEN OHIO AND MISSOURI RIVERS.

PROJECT OF 1881, REVISED IN 1883.

A concise statement of the project for and history of this work will be found in the Annual Report of the Chief of Engineers for 1905, page 424, as well as on page 2631 of the Report of the Chief of Engineers, United States Army, for 1900.

Reference should be made to the Report of the Chief of Engineers, United States Army, for 1894, pages 1577 et seq., for information relating to the development of the various forms of construction and for a résumé of the various types employed between 1872 and 1894, and to the reports of the Chief of Engineers, United States Army, for 1895 (p. 2059), 1896 (p. 1717), 1897 (p. 2012), 1898 (p. 1698), 1900 (p. 2632), and 1901 (p. 2169) for minor details as to forms of construction.

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Since the adoption of this project work has been done substantially according to the methods referred to above at the following localities: Mouth Missouri River, Sawyer Bend, St. Louis Harbor, Cahokia Chute, Arsenal Island, Horsetail Bar, Carroll Island, Twin Hollows, Pulltight, Beards Island, Chesley Island, Jim Smiths, Sulphur Springs, Foster Island, Lucas, Cornice Island, Osborne Field, Rush Tower, Michaels Landing, Fish Bend, Danby Landing, Rush Towhead, Penitentiary Point, Turkey Island, Ste. Genevieve, Kaskaskia Island, Chester, Crain Island, Liberty Island, Liberty Bend, Seventy-six Landing, Willard, Hamburg, Devil Island, Minton Point, Cape Girardeau, Commerce Island, Burnham Island, Powers Island, Goose Island, Buffalo Island, Dogtooth Bend, Greenleaf Bend, Hurricane Field, Greenfield Bend, and vicinity of Cairo.

During the fiscal year ending June 30, 1905, work for the permanent improvement of the river has been carried on, as hereinafter described in the report of Mr. Wm. S. Mitchell, principal assistant engineer.

PERMANENT IMPROVEMENT.

The project adopted for the improvement of the Mississippi River between the mouths of the Ohio and Missouri rivers was approved by the Chief of Engineers, United States Army, March 31, 1881. The estimate of the cost, as revised in 1883, was $16,397,500. The project was modified by the river and harbor act of June 3, 1896, to permit the construction and operation of dredges. It was again modified to some extent in 1903 by the Board of Engineers for Rivers and Harbors in report dated November 12, 1903, the dredging authorization of which was adopted by Congress in the river and harbor act of March 3, 1905. Under the modification of 1903, hurdle work for the contraction of the channel and revetments to prevent erosion of the banks may be considered auxiliary and subsidiary to dredging, which, if found advantageous, is authorized as the chief means of maintaining the channel.

By the report of 1903 the cost is increased $20,000,000 in addition to expenditures already made, provided the projects already in force be adhered to throughout. The cash expenditures to December 31, 1903, are considered as approximately the cost of the work up to the date of the report of the Board. They were $10,476,654.53. The total estimated cost as last revised is therefore $30,476,654.53.

The total amount appropriated to June 30, 1905, was $12,404,999.98. Of this amount $180,000 was alloted by acts and projects for improvement between the Illinois and Missouri rivers, including Alton Harbor, leaving a balance of $12,224,999.98 to be applied to the project for the general improvement between the mouths of the Ohio and Missouri rivers. The balance of the last revised estimate not appropriated June 30, 1905, is therefore $18,251,654.55.

The amount expended to June 30, 1904, was $10,629,390.66. The amount expended during the fiscal year was $716,502.49, of which $716,496.27 was paid by voucher and $6.22 was paid by the Auditor for the War Department. The total amount expended to date is therefore $11,345,893.15.

The balance unexpended June 30, 1905, of the amount appropriated, is $879,106.83, to which must be added $6,262.38, received from mis-

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cellaneous sources, making a total balance of $885,369.21, exclusive of outstanding liabilities and amount covered by contract.

Under the project submitted May 10, 1905, by direction of the Chief of Engineers, United States Army, which was approved May 17, 1905, the balance available June 30, 1905, of the appropriation of April 28, 1904, which is $163,476.48, after deducting outstanding liabilities and amount covered by contract, will be applied during the fiscal year ending June 30, 1906, to emergency works of improvement, care of plant, temporary expedients in dredging, and for engineering and contingencies.

Under the same project the balance available June 30, 1905, of the appropriation of $650,000 in the sundry civil act of March 3, 1905, will be applied during the fiscal year ending June 30, 1906, to alterations of dredges on hand, building two dredges, dredging, and administration and contingent expenses, any balance therefrom to be held in reserve. The balance available is $634,710.56, the sum of $15,289.44 having been paid during the last fiscal year for work done in Sawyer Bend by the Chicago, Burlington and Quincy Railway Company, in 1900 and 1901, as required by the act.

The river and harbor act approved June 3, 1896, provided:

That any balance of former appropriations now available, and the money hereby appropriated and authorized to be expended for the said section of the river between the mouth of the Missouri River and the mouth of the Ohio River, or so much thereof as may be necessary, shall be expended in the construction of suitable dredge boats, portable jetties, and other suitable appliances, and in the maintenance and operation of the same, with the view to ultimately obtaining and maintaining a navigable channel from St. Louis to Cairo not less than two hundred and fifty feet in width and nine feet in depth at all periods of the year, except when navigation of the river is closed by ice.

In the $11,345,893.15 above mentioned is included all amounts expended to June 30, 1905, for dredge plants, portable jetties, and appliances for temporary improvement of the channel and for operating the same, altogether $693,437.02. Of this, $62,600.68 was expended during the fiscal year for dredging. The approximate value of this plant at the beginning of the fiscal year was $181,136.33. Its present approximate value is $168,695.49.

The river and harbor act approved March 3, 1905, relating to this section of the river reads as follows:

Improving Mississippi River from the mouth of the Ohio River to and including the mouth of the Missouri River: The Secretary of War may prosecute the improvement of the said section of the Mississippi River by dredging, as set forth in the report of the Board of Engineers for Rivers and Harbors, submitted November twelfth, nineteen hundred and three; and the said Secretary of War may purchase or cause to be constructed two dredges, to be employed with those now in use in said section for the purpose of dredging; and the said Secretary may, in his discretion, expend a portion of the balance now remaining on hand to the credit of said improvement for the completion of works already under way or for the construction of other works which will be useful in promoting the navigation of said section of the river; and such balance as remains on hand, together with the amount authorized to be expended in pursuance of contracts to be made, is hereby made available for the purpose set forth in this item.

The sundry civil act approved March 3, 1905, making appropriation for this section of the river, reads as follows:

Improving Mississippi River from mouth of Ohio River to Minneapolis, Minnesota: For continuing improvement, in completion of contract authorization, from the mouth of the Ohio River to the mouth of the Missouri River, six hundred and fifty thousand dollars. * * *

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It would appear from the wording of the above items that it is the intention of Congress to materially modify the approved project of 1881 by devoting attention principally to dredging in obtaining and maintaining a navigable channel between St. Louis and Cairo.

By direction of the Chief of Engineers, United States Army, dated May 23, 1903, being the first indorsement on copy of request of the Board of Engineers for Rivers and Harbors, for reports bearing upon the desirability of continuing or modifying certain projects for river and harbor improvement, I submitted to the Board, under date of May 29, 1903, the following report:

The BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington Barracks, Washington, D. C.

SIRS: In answer to first indorsement on a letter, dated May 21, 1903, from the Board of Engineers for Rivers and Harbors to the Chief of Engineers, relating to a discussion of the present method of improving the Mississippi River between the mouths of the Ohio and Missouri rivers, with a view to ascertaining whether by dredging or otherwise a suitable channel can not be established and maintained at less expense than in accordance with the existing project, I have the honor to report as follows:

At the time the present project was adopted hydraulic dredges of great capacity had not come into general use, and the idea of keeping a channel open by means of the small scoop or clam-shell dredges then in vogue was correctly deemed absurd. Since that time, however, dredging has been practically revolutionized, and it has been found practicable to maintain a good low-water channel in the Mississippi River below Cairo by the use of hydraulic dredges of large capacity alone.

The existing project for this district contemplates securing a minimum depth at low water of 8 feet by giving the channel [a] a uniform width of 2,500 feet by means of pile-work hurdles built out from the bank to the necessary extent, and also by means of such temporary expedients as movable dikes—for the purpose of concentrating the flow over bars—and dredging. The banks are to be made permanent where subject to scour by revetment of mattress and broken stone.

This has worked very well in many parts of the river where the width was excessive, as, for example, Horsetail bar, but at other places floods have had a tendency to excavate a channel behind the hurdles, proving that even with the moderate floods that have occurred since the improvement was begun the method is not altogether certain in its results. If we could be sure that the river would maintain the moderate rise and fall that has prevailed in recent years, the method might be worthy of continuance, but it must be kept in mind that the Mississippi River is at times of excessive flood, flowing, as it does, in a soft alluvial bed of 5 miles in width from the Missouri to Commerce, and of much greater width thence to Cairo, virtually uncontrollable by any human agency. In other words, the hurdles put in and maintained at great expense may, in any great flood, be in considerable part wiped out or disarranged and the river assume new courses. This has been its history for thousands of years. It has wandered from one side to the other of its alluvial bed, and it is my opinion that it will so continue in spite of any efforts of man to control it within practical limits of expense.

Viewing the subject from a purely economical standpoint it should be stated that about $9,000,000 has already been expended on the present project, and 6 feet of low-water navigation is all that has been accomplished. To complete the project about $13,000,000 will be required. Owing to the fact that every flood shifts the bottom and forms new bars, I am of the opinion that dredging will have to be resorted to extensively even after the hurdles are completed. The project when completed will have cost, therefore, some $22,000,000. This money is worth at least 4 per cent to the revenue producers, or, say, $880,000 per year. This represents what the funds would be worth in wealth and prosperity producing power if not locked up in the present project of improvement. In addition, however, $150,000 will, as may be inferred from the above statement, have to be appropriated every year for dredging after its completion and $150,000 will be necessary every year for

[a] The original report stated "low channel" by error, the 2,500 feet referring to the bank-full stage.

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repairs, making a permanent fund of $300,000 which Congress will be compelled to appropriate every year after the expenditure of the $22,000,000. Adding this to the $880,000 interest on the latter amount we have $1,180,000, which is what the improvement will be actually costing the country every year after its completion.

Viewing the matter in this light, it has frequently occurred to me to question the propriety of continuing much further along the present lines. It is my present belief that for $500,000 appropriated every year by Congress—which is only $200,000 more than what would be necessary in any event after the completion of the improvement—it would be possible to excavate a channel of 8 or even 9 feet every low water, by means of temporary dikes and dredging, as well as to revet the banks sufficiently to materially diminish the burden of bar-making sediment and incidentally tend to preserve the farming lands and levees and also to put in an occasional hurdle if found expedient.

These figures are only tentative and it may cost somewhat more to annually obtain and maintain the desired channel depths, but I believe that enough has been stated to show that an annual appropriation of even $600,000 would be cheaper in the end than to complete the present project at an expense of $22,000,000.

Very respectfully, your obedient servant,

THOS. L. CASEY,
Major, Corps of Engineers.

The decline of commerce on the river, as shown by statistical tables, constitutes a really serious economical consideration in planning future works of improvement in this district. It is stated by those residents of St. Louis who appear to be still actively interested in the navigation of the river, that if a depth of 8 feet can be assured to them without chance of failure from other cause than ice and can be guaranteed for a number of years in the future, the commerce of the river will revive. In view of this statement, I am of the opinion that the importance of the subject warrants the experiment and would recommend that Congress grant a continuous appropriation of $400,000 a year for ten years for this purpose. If, after the expiration of this period, wherein it can be demonstrated that 8 feet or more has been continually maintained, there appears to be no material increase in the commerce of the river, it is but just to the taxpayers of the country that this particular improvement be suspended indefinitely. I would futher recommend that in obtaining and maintaining this depth of 8 feet or more throughout the year of open navigation, the War Department be given considerable latitude by Congress as to the exact method to be employed to attain this result. There is no doubt that it can be readily accomplished by dredging, but not unless the banks are properly held by revetments at many points and other auxiliary works, such as temporary diking and occasional hurdle building, be permitted.

The amount necessary to complete the project of 1881, including expenditures already made, as given in my letter above, is considerably less than the $30,000,000 or more estimated by the Board of Engineers for Rivers and Harbors in 1903, as stated above. It is probable that the latter estimate falls nearer the truth and renders the principal argument of my report still more patent. In view of this a further expenditure of $4,000,000, as recommended above, in striving to rehabilitate the commerce of the river, enabling us, as it undoubtedly will, to form a definite estimate of the propriety of continuing further appropriations, seems therefore to be conservative and the fairest course to pursue toward the commercial interests of this section.

The expenditure of public funds for the mere and solitary purpose of keeping railroad freight rates within satisfactory bounds, is, in my

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opinion, not a legitimate solution of that problem; first, because these funds are granted by the General Government for the purpose of bettering the facilities for actual navigation, there being many of the chief ports of entry of the country where they could be expended to much better advantage, and, secondly, because there are other ways of reducing the freight charges of the railroads, such as State or national legislation or, better still, actual competition between the railroads themselves, the latter being increasingly evident among the lines paralleling the Mississippi River. A State legislature, if honest and unapproachable, has as much power and capacity to regulate the prices to be paid per ton for freight handled by the railroads within its boundaries as it has to regulate passenger rates.

The appended report of Mr. Wm. S. Mitchell, principal assistant engineer, gives full details of operations at the various localities in this district on construction work, temporary expedients, dredging, repair and care of plant, procuring materials, operations of quarry, gauges, and discharge observations, during the past fiscal year.

Money statement.

July 1, 1904, balance unexpended		$949,313.93
July 1, 1905, miscellaneous receipts		2,557.77
Amount appropriated by sundry civil act approved March 3, 1905		650,000.00
		1,601,871.70
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$503,203.20	
For maintenance of improvement	213,299.29	
		716,502.49
July 1, 1905, balance unexpended		885,369.21
July 1, 1905, outstanding liabilities		28,302.17
July 1, 1905, balance available		[a] 857,067.04
July 1, 1905, amount covered by uncompleted contracts		48,880.00
Amount (estimated) required for completion of existing project		18,251,654.55
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$200,000.00	
For maintenance of improvement	200,000.00	
		400,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

[a] Distributed under subheadings as follows:

For protection of bank on Missouri side and to deepen and straighten channel at Wittenberg, Mo., act of March 3, 1899	10.000.00
For from mouth of Ohio River to mouth of Missouri River:	
Act of April 28, 1904	212,356.48
Act of March 3, 1905	634,710.56
Total	857,067.04

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LIST OF APPROPRIATIONS.

By act of—		By act of—	
June 10, 1872	$100,000.00	August 18, 1894	$758,333.33
March 3, 1873	200,000.00	March 2, 1895	758,333.33
June 23, 1874	200,000.00	June 3, 1896	275,000.00
March 3, 1875	200,000.00	June 4, 1897	673,333.33
August 14, 1876	200,000.00	July 19, 1897	325,000.00
June 18, 1878	240,000.00	July 1, 1898	673,333.33
March 3, 1879	200,000.00	March 3, 1899	673,333.33
June 14, 1880	250,000.00	June 6, 1900	100,000.00
March 3, 1881	600,000.00	June 13, 1902	650,000.00
August 2, 1882	600,000.00	March 3, 1903	650,000.00
July 5, 1884	520,000.00	April 28, 1904	650,000.00
August 5, 1886	375,000.00	March 3, 1905	650,000.00
August 11, 1888	300,000.00	Other receipts	6,262.38
September 19, 1890	400,000.00		
July 13, 1892	525,000.00		12,411,262.36
March 3, 1893	658,333.33		

CONTRACT IN FORCE JUNE 30, 1905.

Name.	Articles.	Rate.	Date of contract (1905).	Date of beginning (1905).	Date of expiration (1905).
Howard Ship Yards Co., Jeffersonville, Ind.	4 wooden flat barges.. 30 wooden flatboats ..	$5,770 each . 860 each .	Jan. 31	Promptly after signature of contract.	June 30[a]

[a] Work suspended, awaiting decision on letter dated May 27, 1905, recommending annulment.

COMMERCIAL STATISTICS.

Receipts and shipments at St. Louis, Mo., during the year 1904.

	Tons.
Receipts:	
Barbed wire, ores, and metals (pig and manufactured)	
Coal and coke	
Cotton and cotton products	204
Groceries and dairy products	206
Hay, seed, grain, flour, meal, etc	28,111
Live stock and products	24,928
Lumber	406
Merchandise and sundries	238,496
Vegetables and fruits	2,879
White lead, oils, etc	
Wines and liquors	5
Wool	135
Total	295,370
Shipments:	
Barbed wire, ores, and metals (pig and manufactured)	1,851
Coal and coke	6
Cotton and cotton products	303
Groceries and dairy products	5,667
Hay, seed, grain, flour, meal, etc	10,039
Live stock and products	2,032
Lumber	2,197
Merchandise and sundries	57,668
Vegetables and fruits	1,200
White lead, oils, etc	1,163
Wines and liquors	439
Wool	
Total	82,565

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Transferred by ferries across the river at St. Louis.

	Tons.
1901	5,860,592
1902	5,731,635
1903	6,328,154
1904	6,080,109

Shipments of grain, including flour, meal, etc., and coal down the river from landings between St. Louis and Cairo, during the year 1904, amounted to 43,672 tons.

List of steam-power boats that arrived at St. Louis during the year 1904.

Size of boats.	Draft.	Number.	Times arrived.
	Feet.		
Under 500 gross tons	2.5 to 6	90	1,206
Between 500 and 1,000 gross tons	4 to 7.6	9	790
Over 1,000 gross tons		0	0
Total		99	1,996

List of barges and scows that arrived at St. Louis during the year 1904. [a]

Size of boats.	Draft.	Number.	Times arrived.
	Feet.		
Under 500 gross tons	2.5 to 7.5	271	397
Between 500 and 1,000 gross tons	5.2 to 8	7	17
Total		278	414

[a] Including Government vessels.

Number of vessels, and their tonnage, permanently and temporarily enrolled and licensed at the port of St. Louis, Mo., December 31, 1904. [a]

	No. of vessels.	Gross tonnage.	Net tonnage.
Permanent enrolled steamers (wood)	67	19,668	17,793
Permanent enrolled steamers (iron and steel)	9	3,080	2,347
Permanent enrolled barges (wood)	8	1,151	1,151
Permanent enrolled barges (steel)	1	1,162	1,162
Permanent enrolled steam yachts (wood)	3	271	173
Permanent enrolled steam yachts (steel)	2	177	123
Permanent enrolled sailing yachts (wood)	0	0	0
Permanent enrolled sailing yachts (steel)	1	62	62
Temporary enrolled steamers (steel)	1	25	25
Licensed steamers (wood)	16	187	149
Licensed steamers (steel)	2	56	29
Licensed barges	1	16	16
Licensed sailing yachts (wood)	1	9	8
Licensed steam yachts (wood)	3	35	29
Total	115	25,849	23,067

[a] Exclusive of Government vessels.

Total cost and work done to June 30, 1905.

Hurdles.	New.	Repairs.		Total cost.
		Restoration.	Maintenance.	
	Lin. ft.	*Lin. ft.*	*Lin. ft.*	
Prior to July 1, 1904	406,909	5,925	32,435	$6,023,059.47
During fiscal year 1905	4,350	2,190	2,955	200,212.28
Total	411,259	8,115	35,390	6,223,271.75

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Total cost and work done to June 30, 1905—Continued.

Bank protection.	Mattress.			Revetment.		Total cost.
	New extensions.		Repairs, maintenance.	New.	Repairs, maintenance.	
	Lin. ft.	*Square ft.*	*Square ft.*	*Square ft.*	*Square ft.*	
Prior to July 1, 1904	258,087	29,987,316	569,455	11,530,182	1,147,500	$2,544,283.96
During fiscal year ending June 30, 1905	34,190	4,095,630	286,420	1,359,954	1,050,092	371,051.44
Total	292,227	34,082,946	855,875	12,890,136	2,197,592	2,915,335.42

Recapitulation.

Dikes and dams:		
Prior to July 1, 1904, 39,367 linear feet	$814,358.33	
During fiscal year 1905		
		$814,358.33
Jetties:		
Prior to July 1, 1904	114,603.53	
During fiscal year 1905		
		114,603.53
Dredging:		
Prior to July 1, 1904	295,425.19	
During fiscal year 1905	62,600.68	
		358,025.87
Surveys, examinations, gauges, etc.:		
Prior to July 1, 1904	244,687.98	
During fiscal year 1905	13,847.64	
		258,535.62

Recapitulation.

Hurdles	$6,223,271.75
Bank protection	2,930,624.86
Dikes and dams	814,358.33
Jetties	114,603.53
Dredging	358,025.87
Surveys, examinations, gauges, etc	258,535.62
Total	10,699,419.96

Property account.

Class.	Value July 1, 1904.	Debits.	Credits.	Value June 30, 1905.
Steamer Gen. T. L. Casey	$11,025.40	$14,644.74	$16,236.53	$9,433.61
Steamer Gen. H. L. Abbot	18,006.36	19,981.06	20,359.80	17,627.62
Steamer Wm. R. King	54,775.62	34,150.71	37,387.95	51,538.38
Dredge No. 1	6,351.85	34.56	951.52	5,434.89
Dredge No. 2	8,483.78	1,857.51	3,082.35	7,258.94
Dredge No. 3	81,284.28	15,736.90	20,540.80	76,480.38
Dredge No. 4	79,496.96	18,215.95	22,914.22	74,798.69
Steam tenders, wood	14,991.37	4,601.50	6,770.50	12,822.37
Steam tenders, steel	44,263.34	1,785.79	4,401.75	41,647.38
Barges, model	126,857.97	31,797.25	33,522.89	125,132.33
Barges, flat		4,993.36	1,298.04	3,695.32
Store boat	1,863.78	18.10	287.18	1,594.70
Quarter boats	17,894.62	2,697.83	5,281.37	15,311.08
Office and survey boats	9,208.59	3,967.15	2,544.11	10,631.63
Pile drivers	47,700.17	7,429.56	11,813.37	43,316.36
Derrick boats	3,338.79	766.15	672.50	3,432.44
Derricks	2,120.95	68.46	374.61	1,814.80
Flats, wood		14,568.77	1,092.28	13,471.49
Flats, steel	13,109.19		774.76	12,334.43
Small boats	20,657.91	7,397.92	25,465.83	2,590.00
Portable quarters	1,395.84	731.37	932.90	1,194.31
Jetty gates	5,519.46		796.87	4,722.59
Engineer depot	16,664.04	12,661.18	8,517.70	20,697.52
Tools and appliances	17,200.90	13,487.10	14,518.70	16,169.30
Boarding outfit	14,598.13	4,475.89	5,475.72	13,598.30
Office furniture	502.62	341.49		844.11
Survey instruments	1,199.02	11.48	173.11	1,037.39
Models (Louisiana Purchase Exposition)	522.12		522.12	
Total	618,923.06	216,416.78	246,709.48	588,630.36

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Material account.

Class.	Value July 1, 1904.	Debits.	Credits.	Value June 30, 1905.
Subsistence	$1,450.07	$56,160.17	$55,068.73	$2,541.51
Piles	3,544.60	47,934.88	37,947.47	13,532.01
Stone	373.05	161,381.67	161,754.72	
Rope	30,889.69	16,625.99	13,040.02	34,425.57
Wire	1,068.91	7,260.50	7,226.19	1,118.22
Iron	3,218.12	1,139.27	1,444.37	2,913.02
Nails	1,226.77	1,264.13	1,982.85	508.05
Spikes	1,286.99	471.70	866.20	892.43
Lumber, miscellaneous	9,991.33	22,953.68	17,899.31	15,045.70
Lumber, mattress	38.02	85,681.81	76,641.95	9,077.88
Oakum	652.04	645.00	969.22	327.82
Coal	2,880.27	49,636.08	50,278.38	2,187.92
Ice		3,846.47	3,846.47	
Material, miscellaneous	14,770.56	21,705.65	23,542.84	12,933.37
Total	71,305.27	476,806.95	452,008.72	95,603.50

Engineer Office, United States Army, in account with United States from 1870 to June 30, 1905.

To allotments, appropriations, etc., prior to July 1, 1904:

1872–1880.	Allotment for surveys	$51,208.77	
1876–1897.	Special appropriations	401,600.00	
1879–1904.	Miscellaneous receipts	5,860.44	
1872–1904.	Appropriations for general improvement	11,779,999.98	
			$12,238,669.19
Mar. 3, 1905.	Appropriation, Mississippi River between Ohio and Missouri rivers	650,000.00	
Mar. 3, 1905.	Allotment for survey of harbor and approaches to St. Louis	2,800.00	
			652,800.00

To miscellaneous receipts deposited:

Feb. 6, 1905.	Sale of condemned property		2,349.80
June 27, 1905.	Unclaimed wages due employees		110.62
Jan. 5, 1905.	Disallowed by Auditor for War Department		3.52
Mar. 1, 1905.	Refunded for lost anchor		7.50
June 27, 1905.	Sale of blueprints		2.13
Sept. 30, 1904.	Refunded from allotment for Board of Engineers for Rivers and Harbors		84.20
June 30, 1905.	Unpaid percentage on annulled contract	$900.17	
	Unpaid percentage on contracts in force	7,418.46	
	Unpaid labor	9,738.18	
	Unpaid miscellaneous	12,905.36	
			30,962.17
	Total		12,924,989.13

June 30, 1905.	By construction between Illinois and Missouri rivers:		
	Piasa Island dam	$37,910.41	
	Piasa Island dam, cutting channel	3,116.86	
	Alton dam	33,740.05	
	Alton dike	126,652.74	
			201,420.06
	By construction between Ohio and Missouri rivers		9,968,254.94
	By jetties		114,603.53
	By dredging		358,025.87
	By surveys and gauges		258,535.62
	By withdrawn for Office of Chief of Engineers		2,220.50
	By withdrawn for Board of Engineers for Rivers and Harbors		800.00
	By loss account		448,203.42
	By property on hand		588,630.36
	By material on hand		95,603.50
	By models for Louisiana Purchase Exposition, 1904		522.12

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June 30, 1905.	By appropiations unexpended:		
	Mississippi River, Ohio to Missouri.	$885,369.21	
	Allotment for survey of harbor and approaches to St. Louis.....	2,800.00	
			$888,169.21
	Total		12,924,989.13

REPORT OF MR. WM. S. MITCHELL, ASSISTANT ENGINEER.

ST. LOUIS, MO., *June 30, 1905.*

MAJOR: I have the honor to submit the following report of operations for the improvement of the Mississippi River between the mouths of the Ohio and Missouri rivers during the fiscal year ending June 30, 1905:

Works of permanent improvement of various kinds, as will be hereinafter described, were carried on at the following localities: Bank opposite the mouth of the Missouri River, Sawyer Bend, Mo,, Pulltight, Ill., Rush Tower, Mo., Osborne Field, Ill., Fish Bend, Ill., Danby Landing, Mo., Penitentiary Point, Ill., Ste. Genevieve, Mo., Horse Island, Mo., Crain Island, Mo., Liberty Bend, Ill., Willard Landing, Ill., Devil Island, Ill., Minton Point, Ill., Cape Girardeau, Mo., Dogtooth Bend, Mo., Greenleaf Bend, Ill., Hurricane Field, Mo., and Greenfield Bend, Mo. Such local surveys and examinations were made as were needed; gauges were read throughout the year and discharge observations were taken throughout the fall season; stone was quarried at Little Rock; the plant was repaired and cared for at the engineer depot, St. Louis, and in the fleets at Claryville, Mo., and Santa Fe, Ill.; dredges were in operation at a number of the bars developed during the low-water season of navigation. In addition there were begun a study for a report on the "Harbor and approaches to St. Louis, with a view to the prevention of floods in the Mississippi River," and designs for the construction of two self-propelling suction dredges of Kappa (M. R. C.) type, as required by acts of Congress approved March 3, 1905.

The conditions of river and weather were most favorable for the prosecution of the work during both fall and spring working seasons, the former remaining at a fairly good boating stage throughout the low-water season and at an unusually moderate stage during the high-water season of the spring and summer, and but little interruption was had from storms or rain during either season. The intervening winter was unusually severe, but on the breaking up of the ice in the spring the numerous and extremely heavy ice gorges which had formed passed out without damage to the plant in harbors opposite Chester, Ill., and Santa Fe, Ill., though with some destruction of exposed hurdles, notably at Fish Bend, Ste. Genevieve, and Crain Island.

Work was carried on very actively during the fall and preparations had been made to that end for the spring, but the radical change of plan for the improvement of the river in this district enacted in the river and harbor bill of the last Congress caused an absolute suspension of all field work May 1, when the force was disbanded and plant again placed in harbor to await the resumption of dredging in the fall. During the spring season, thus made short, considerable work of repair was done to the hurdles damaged by the ice during the winter.

The organization and superintendence of the field forces for construction works were in the local charges of Assistant Engineers W. M. Penniman and F. Y. Parker and Junior Engineer J. W. Skelly; local surveys, discharge measurements, and buoying the low-water channel were under Assistant Engineer Parker and Junior Engineer Philip Florreich, jr.; the repair and care of all plant, procuring stone at the quarry at Little Rock, and the purchase and distribution of subsistence and supplies were in charge of Assistant Engineer C. D. Lamb.

During his long and severe illness (September to November), and in the spring, while he was engaged upon the designs of dredges and the study for the prevention of floods, the field parties of Mr. Penniman were under the immediate direction of Mr. Jas. E. Kennedy, master of dredge *No. 2*.

The dredges in operation, *Nos. 3* and *4*, were in charge of Masters of Dredges Wm. Baxter and L. H. Yourtree, respectively.

Reports from the assistants, giving the details and accompanied by charts showing the locations of the work done, are on file, and are the sources from which this report is largely taken.

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The changes in organization were the promotion of Surveymen Daily and Luther to the grade of junior engineer transitmen, the former having been engaged on discharge measurements, gauge records, and maps during the year, and the latter on construction work under the immediate orders of Assistant Parker.

The office has suffered great loss in the death, November 19, of Mr. John Illien, draftsman, who, since 1880, has performed so satisfactorily all the duties of his office.

CONSTRUCTION WORKS.

Midbank distances from the Illinois and St. Louis bridge, St. Louis, are quoted with the notices of work done at the various localities. River stages refer to the St. Louis gauge.

Bank opposite the mouth of the Missouri River (15 miles above St. Louis).—In 1899, 1900, and 1903 the Illinois bank at this locality was continuously protected below the plane of low water with standard mattresses of lumber for 13,770 feet of its length; above these mattresses the bank was completely revetted with stone for 12,500 feet, and partially for the remaining distance.

During the fall season (October and November) the low-water protection was extended 3,850 feet to the head of Chouteau Slough. The stonework of the reach was found in general to be in good condition, but was repaired where necessary, and the completed portion was extended about 800 feet, the remainder of the protected bank being revetted to an average height of the 10-foot stage of river.

The present status of the work is as follows:

	Feet.
Entire length of bank protected with mattress	17,620
Length of protection fully completed with stone above the mattress to the average level of 20-foot to 24-foot stages, depending on the height of bank.	13,300
Length of bank at lower end of work, partially protected above mattress with stone to average level of 10-foot stage	4,320

In the last stretch the bank was left vertical above the stonework, grading not having been attempted, as it will be accomplished, in great part at least, by the spring high water.

Sawyer Bend, Mo. (7 miles above St. Louis).—In January and February repairs were made, under the inspection and supervision of this office, to the revetment at this place by the Chicago, Burlington and Quincy Railway Company, the original builders of the revetment. About 11,250 square feet of stonework were laid.

Pulltight, Ill. (15 miles below St. Louis).—At the beginning of the year work was in progress in continuation of the effort to restore the Illinois bank line to the original east channel limit by building short hurdles across the eroded area, the construction of hurdle No. 1 having been begun in June. This hurdle is 900 feet in length, and was fully completed early in July, 300 feet having been built during the month, with buttress and T-head at its outer end.

In October a few repairs were made to hurdle No. 3/8, which had been slightly damaged by the high water of June and July, 1904, and the stone in its T-head was raised and increased in volume.

Osborne Field, Ill. (35 miles below St. Louis).—The Illinois bank at this place having caved rapidly and the channel threatening to follow it and become shoal, it was decided to hold the bank with an extension, upstream, of the original protection in this reach, placed in 1892. Work was begun November 4 and was continued until December 10. A mattress was placed, 3,700 feet in length by only 100 feet in width, narrower than standard width because of the comparatively shallow water encountered. About 1,600 feet of the bank above the mattress were graded and protected with stone to the level of the 19-foot stage; 1,850 feet were graded and revetted to the level of the 11-foot stage, but on account of the lateness of the season the remainder, 250 feet, were not revetted above the mattress.

There is an interval of unprotected bank, about 2,600 feet, between the new work and that of 1892.

Osborne Towhead, Mo. (Rush Tower, Mo., 36 miles below St. Louis).—In October and November repairs were made to the stonework in the revetment on the east side of this towhead, that bank having suffered severely in the last two high waters. The revetment was put in thorough order, and was restored between the 14-foot and 24-foot levels, the work extending along 950 feet of bank.

Fish Bend, Ill. (40 miles below St. Louis).—By gradual erosion the river had become excessively wide at this point and had practically destroyed hurdle No. 3 (built in 1893, although never extended to its full length to the channel limit) and 600 feet of bank protection at the upper end of Rush Towhead. It was decided to restore this bank to the channel limit originally intended, by the construction of a new hurdle

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immediately above the wreck of the old one. This was done in October and November. The structure was 1,650 feet in length, and was very strongly built and fully completed with channel-end buttress and T-head.

During the winter the river stage was very low and little or no deposit was secured below the newly built hurdle, and the immense fields of very heavy ice which had formed in the many gorges above its locality, in passing out on the first spring rise, destroyed the greater part of the line, only 385 feet remaining uninjured next the shore, together with another short section 60 feet in length near the outer end of the line. Examination in the spring showed the foundation to be intact; but to allow for unavoidable injury to it in redriving the piling, another mattress 65 feet in width and 950 feet in length was laid over the original foundation across the main gap in the line. The piling was restored and the hurdle was again completed and strengthened, its final length being 1,680 feet from shore to T-head and buttress.

The work of restoration was done March 27 to May 5.

In addition, at this locality, a small hurdle dam 200 feet in length was built in April across a slough 500 feet below hurdle No. 3. The dam is located 550 feet below the head of the slough which it completely closes, and which formerly, at high stages, drew off from the main river a considerable volume of water.

Danby Landing, Mo. (*40 miles below St. Louis*).—This revetment was begun in 1895, since which time it has been repaired and extended as needed. During the past year, August, September, and November, 1904, and April, 1905, the stonework was thoroughly repaired to the level of the 25-foot stage, and is now entirely complete for 4,750 feet in length between the original ends of the revetment. The mattress was extended in the fall for 3,812 feet along the shore of Lee Island (to station 85+50) and the stonework above the new mattress was carried to the level of an 18-foot stage. The remaining height of stonework will be placed after the upper bank has been graded by the high water.

At the head of the work the bank above the 700 feet of mattress placed in 1898 remains unrevetted with stone, but there is as yet no necessity for such completion of the protection.

The entire length of partially and completely protected bank is 9,262 feet.

At station 60, in the revetment, a small slough 65 feet wide (between Ames and Lee islands) was closed by a small and light hurdle dam. This slough parallels the protected bank for about 2,000 feet, at an average distance from it of less than 100 feet. The unrestricted volume of water flowing through it at high stages is considerable and would be a menace to the protection.

Penitentiary Point, Ill. (*42 miles below St. Louis*).—This revetment was begun in 1900, and was extended and repaired in subsequent years. During the year—July and August—the stonework was very thoroughly repaired and raised to the level of the 25-foot stage.

In a large circular cave in the bank about 1,300 feet below the upper end of the work, a pocket mattress was sunk and a light spur hurdle was built to break the force of the eddy current that had there been formed.

The total length of protection is now 4,220 feet, fully completed.

Ste. Genevieve, Mo. (*60 miles below St. Louis*).—The protection was placed 1897–1901, and has been repaired since whenever necessary. During the high water of 1904 a cave in the bank occurred about 4,250 feet below the head of the revetment and a spur hurdle to stop the eddy was built in it late in November. In the spring pocket mattresses were built at several places where the revetment had slipped during the winter, and the spur hurdles in former caves were repaired and a new one built at station 27. The entire length of this revetted bank is 5,900 feet, but it requires further minor repairs, work having been stopped at this locality on the suspension of operations in May.

HURDLES.

Hurdle No. 18, built in 1898 at the head of the revetment at this locality, was originally 500 feet in length and was designed to strengthen and protect the upper end of the revetment, but, by gradual encroachment of the river, its length had been reduced to less than 100 feet. The end of the line was strengthened with piling and stone just at the close of the spring season.

Hurdle No. 25.—The high water of last year destroyed about 300 feet of the outer end of this hurdle and left 130 feet more in a weakened condition. This portion of the line was strengthened in November and December, and a new T head was driven at its outer end and was filled with a buttress of stone.

This hurdle suffered severely from ice during the winter, about 250 feet of the piling being destroyed.

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Chester, Mo. (*Horse Island, 69 miles below St. Louis*).—The protection was placed in 1897–98. It is 4,346 feet long, but has been badly damaged in the downstream two-thirds of its length.

Repairs had already been begun at the beginning of the fiscal year and were continued during July and August. The stonework at the upper end of the revetment for 1,800 feet, on account of its exposed position, was raised to the top of the bank at about the 34-foot level. Several pocket mattresses were placed and spur hurdles were driven in the caves newly developed in the bank, and those previously driven were strengthened. The remainder of the bank, except 300 feet at the downstream end of the protection, was covered with stone to about the 30-foot level. The total length of completed protection is now about 4,000 feet.

Crain Island, Mo. (*73 miles below St. Louis*).—Hurdle No. 1. Repairs to this hurdle were in progress at the beginning of the year and were completed early in July, but later in that month the high water broke the line for the second time near the middle of the chute. This break, 150 feet in length, was also repaired, though in restoring the line across it about 250 linear feet of new hurdle were built. During the winter a third break was made by the ice, but the damage was slight and was easily repaired in the spring, when also a small accumulation of drift along the west end of the hurdle was sunk as a further protection to that part of the line.

BANK PROTECTION.

The head of Crain Island had been revetted for 1,519 feet in June, 1904, of which length 1,370 feet had been along the outer or main river bank. In August, an extension of this revetment was begun, which was continued intermittently until the bank along the entire present channel-swept river front (6,355 feet) had been protected, the mattress laid this season extending the protection 4,985 feet. Stonework had been laid in June, 1904, above the upper end of the mattress to the bank top. Above this year's extension the stonework was laid to the 26-foot stage as far as station 17, to the 18-foot stage as far as station 53, and for the remaining distance (to station 63+55) to the foot of the abrupt bank at heights varying between the 20-foot and 12-foot stages. Grading was not attempted, the full completion of the stonework having been intended for the coming year, after the passage of the summer high water, which was expected to do the larger part of the grading.

Liberty Bend, Ill. (*81 miles below St. Louis*).—A force was engaged in the repair and extension of the revetment at this place from the latter part of August until the early part of November. The stonework previously laid was thoroughly repaired, and, in addition, about 1,650 feet of bank was completed, making the total length of completed revetment 12,625 feet. A new mattress was built extending the length of the protected bank 2,625 feet, and making the total length of bank, completely and partially protected, 16,025 feet. Above the mattress in the incomplete section (3,400 feet) at the lower end of the work stone was laid to about the level of the 20-foot stage.

In addition, the old subaqueous mattress was repaired or replaced, wherever injured, with small sections of new mattress, and pocket mattresses were built in several slides or caves in the bank.

Willard Landing, Ill. (*111 miles below St. Louis*).—The construction of a hurdle to close the chute between the Illinois shore and the high middle bar opposite Vancil Landing, Mo., was begun June 24, 1904, in the last days of that fiscal year. It was completed July 28. The hurdle is of the usual type, 1,250 feet in length, and in effect is a permeable dam, each end being fixed against a high revetted bank.

Devil Island, Ill. (*121 miles below St. Louis*).—The hurdle across the chute at the head of Devil Island, built in 1897, had suffered severely from floods and ice for several years and was in need of repair. In October the piling was thoroughly restored for 900 feet of the length of the hurdle, and was extended 60 feet to the top of the high island bank, the foundation having been found intact.

In July the stonework in the revetment on the west side of the island was repaired and 2,950 feet of it were raised to the top of the bank at about the 30-foot stage, making the total length of completed revetment 3,800 feet. About 2,850 feet more are incomplete, and vary in height between the levels of the 14-foot and 10-foot stages.

Minton Point, Ill. (*125 miles below St. Louis*).—To relieve the harbor at Cape Girardeau, Mo., which for several years has been obstructed by a persistent and troublesome bar throughout its entire length, and lying close to the paved wharf, a system of four hurdles was designed to project from the Illinois bank above and opposite the town, to contract the waterway and direct the flow into the harbor and thus remove the obstruction. It was decided to build during the past year only two (Nos. 1 and 3) of this series of hurdles.

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Hurdle No. 1 was located about 1 mile above the old railway incline at East Cape Girardeau, Ill., and No. 3 was 2,000 feet below No. 1.

The hurdles were begun July 29 and were completed in October. The variations in their structure from the ordinary type were only such as were suggested by the local conditions.

They are 1,000 feet and 1,900 feet, respectively, in length, and are fully completed with well revetted shore ends and T heads and strong riprap buttresses at their channel ends.

In the spring, March 24 to April 15, a drift mattress was built and sunk over the accumulated drift of the winter along the upper side of each hurdle for its entire length.

The effect of these hurdles upon the obstructing bar has been very marked, although the complete result will not be seen until low-water season.

Cape Girardeau, Mo. (*124½ miles below St. Louis*).—Due to the deflection of the current by the hurdles just built at Minton Point, the Missouri bank, in the spring, began to cave rapidly for nearly half a mile on each side of Sloan Creek, endangering and causing bad slides in the tracks of the St. Louis, Memphis and Southeastern Railway, whose tracks here skirt the high bank, and causing one of the basins of the Cape Girardeau reservoir to settle and crack. To protect this bank a subaqueous mattress, 80 feet wide, was laid in April, in two sections, in length 1,200 feet above and 2,140 feet below Sloan Creek.

Prior to and during the construction of this mattress the St. Louis, Memphis and Southeastern Railway Company was engaged in grading the bank and revetting it with stone heavily laid from the edge of the mattress referred to to the top of the high bank.

Dogtooth Bend, Mo. (*156 miles below St. Louis*).—Bank protection at this place was begun October 7, the bend having caved as deeply as it was thought advisable to allow it to go. The subaqueous mattress was placed in two sections, an upper section 1,800 feet long, and a lower, 5,665 feet, the two being separated by 4,265 feet of heavily timbered bank, which was not then caving or in need of immediate protection.

The stonework above these mattresses was placed to the foot of the abrupt bank at about the level of the 13-foot stage.

At the lower end of the work (the upper end of Thompsons Bend) the channel leaves the Missouri shore and passes over to Dogtooth Island.

Greenleaf Bend, Ill. (*162 miles below St. Louis*).—The works at Greenleaf Bend proper and Beechridge are both included in the above caption. They are protection works and have been in progress since 1898. They lie 3,200 feet apart and are 7,575 feet and 10,430 feet long, respectively.

The work of the past season consisted of repairs and the completion of the work previously begun. In the upper stretch, at Greenleaf Bend, the completed work, previously reported, extended to the 30-foot level for 4,600 feet from its upper end. From this point the revetment was raised until at the close of the season the stone was left at the levels of 22-foot to 27-foot stages over a distance of 2,975 feet.

At Beechridge the work was confined to the repair of the lower end of the revetment, about 1,400 feet of the bank being worked upon, leaving the entire work completed to the level of about the 30-foot stage for 9,000 feet in length, thence sloping to the 23-foot level in the following 600 feet and rising again to the 26-foot level throughout the remaining 830 feet.

Hurricane Field, Mo. (*165 miles below St. Louis*).—The work consisted of the extension and the completion of the protection (5,060 feet long) placed in 1903. The lower end of the work was found to have been damaged by caving banks and was relaid and repaired. The mattress was extended downstream 1,095 feet and upstream, following the caving bank, 2,160 feet. Stone was laid above the new mattresses to the foot of the abrupt bank and the old stonework was raised up the bank, though not to its ultimate full height.

The total revetted bank is now 8,315 feet in length, of which the upper 2,160 feet is protected to the levels of stages 11 feet to 15 feet, the middle 3,100 feet to stages 20 feet to 28 feet, and the lower 3,055 feet to 17-foot to 11-foot levels.

Greenfield Bend, Mo. (*172 miles below St. Louis*).—Late in November minor repairs were made to this revetment, which was laid in 1903.

The stonework was raised to higher levels for 500 feet at the upper end of the work, and the repairs extended over a total length of 1,500 feet of bank. The revetment, which is 1,925 feet in length, now reaches the levels of stages varying from 20 feet to 16 feet.

A large pile of granite riprap lying out in the steamer channel near this bank, and once forming part of the bank revetment placed for the protection of their incline

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by the railway companies at Bird Point, became very dangerous on the approach of low water and was demolished by dynamite by the snag boat *Wright* in October.

The following table shows the amounts of work done at the various localities during the fiscal year:

Locality.	Hurdles.			Bank protection.				
		Repairs.		Mattress.			Revetment.	
	New.	Restoration.	Maintenance.	New extensions.		Repairs and maintenance.	New.	Repairs and maintenance.
	Lin. ft.	*Lin. ft.*	*Lin. ft.*	*Lin. ft.*	*Sq. ft.*	*Sq. ft.*	*Sq. ft.*	*Sq. ft.*
Mouth of Missouri River				3,860	501,800		191,040	120,780
Pulltight, Ill		300	435					
Osborne Field, Ill				3,700	370,000		100,074	
Osborne Towhead, Mo								58,380
Fish Bend, Ill	200	1,650	1,300					
Danby Landing, Mo				3,800	612,860	10,400	268,290	87,105
Penitentiary Point, Ill						19,500		161,668
Ste. Genevieve, Mo		75	10			31,120		52,380
Chester, Mo. (Horse Island)						78,600		236,900
Crain Island, Mo		165	250	4,985	516,000		287,300	1,875
Liberty Bend, Ill				2,625	302,100	146,800	225,700	119,600
Willard Landing, Ill	1,250							
Devil Island, Ill			960					35,500
Minton Point, Ill	2,900							
Cape Girardeau, Mo				3,340	267,200		20,000	
Dogtooth Bend, Mo				7,540	966,400		111,200	
Greenleaf Bend, Ill							56,120	96,580
Beechridge, Ill							31,000	16,400
Hurricane Field, Mo				4,340	559,270		69,230	31,295
Greenfield Bend, Mo								31,719
Total	4,350	2,190	2,955	34,190	4,095,630	286,420	1,359,954	1,050,092

TEMPORARY EXPEDIENTS.

Dredging was carried on with dredges *Nos. 3* and *4* in commission from July 26 till December 15. The work was not continuous, as the dredged cuts were effective after completion and the general condition of the river channel was satisfactory. During the time of operations 8 feet depth was maintained except for short periods (until a dredge could reach the shoal) when a least depth of 7 feet was found.

On the approach of cold weather the dredges were sent to winter harbor in anticipation of ice. Between this time, November 23, and the close of navigation, the river fell rapidly and the channel depth shoaled to 5 feet.

The following bars were operated upon:

Osborne Towhead.

Little Rock quarry, to remove obstructing bar at lower derrick.

Moro Island railroad incline, to secure channel to railway incline for car transfer boat.

Stanton Crossing.

Grand Tower Island Bend.

Mouth of Big Muddy River, to remove bar obstructing navigation of the Big Muddy River.

Schoenemann Crossing.

Head of Devil Island.

Blackbird Island.

The total amount of sand excavated was about 525,000 cubic yards in nine hundred and eighty-five hours' dredging, or at the rate of 533 cubic yards per dredge hour, and the final cost was about 10 cents per cubic yard, but, of course, this includes the cost of all idle time of the dredges and their crews and the repairs and upkeep of the former during the entire year.

The dredges were in actual operation only about 20 per cent of the time they were in commission. The expense of running them for the entire time would have been increased only by the small charge for fuel and oils, and the reduction in cost for such continuous operation would have been about 75 per cent, or to 2½ cents per yard.

Such fluctuations in the cost of the work are necessarily incident to the demand for dredging and are due to river conditions which can not be anticipated, although the dredges must be held in readiness for any conditions that may arise.

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PLANT.

The structures and efficiency of the plant were maintained by extensive and ordinary repairs as were required. No additions were made to any of the classes of the floating plant, but plans were drawn and a contract made for building 4 barges and 30 flatboats, all to be of creosoted wood, to replace vessels that have been worn-out and condemned. The new barges are to be about 50 per cent greater in carrying capacity than those in present use and of scow type instead of with modeled ends. The flats also are to be larger than those now on hand. Actual construction was barely begun by the contractors when, because of the radical change of plan by Congress for the improvement of this section of the river, work was stopped and a proposition was made to the contractor and accepted by him to annul the contract. This was recommended to the Department, but the decision had not been received at the close of the year. Pending the decision work upon the contract is suspended.

The repairs, extensive and ordinary, to all classes of the plant were made in general at the engineer depot, St. Louis, although minor repairs and such preparation of vessels for service as their periodic calking were done in the field and at the fleets.

Towboats.—All of the large steamers—the *Abbot*, *Casey*, and *King*—received ordinary repairs incident to the usual wear and upkeep. In addition, the *Abbot* was docked in May for the purpose of resecuring the main chains, and advantage was taken of the opportunity to overhaul the hull planking and rudders, and a filtering plant of 100 gallons of clear water per hour was set up in the engine room of the *King*. All three towboats are now in excellent condition for service.

Steam tenders.—The wooden steam tenders, *Nos. 3*, *4*, and *5*, have all been docked during the year, the hulls of the first and last being practically rebuilt, and *No. 4* is now on the ways undergoing similar repairs.

The newer wooden tenders, *Nos. 6* and *7*, and the steel tenders, *Nos. 8*, *9*, and *10*, which received only minor repairs, are in good condition.

Dredges.—Of the four dredges, *No. 1* was condemned and dismantled. This was a jet dredge of very small efficiency, with machinery and cabin mounted on a barge. The machinery will be used for other purposes, the two centrifugal pumps, with their engines, being admirably suited for the jets in the two dredges to be built. The hull will revert to barge service.

Dredge *No. 2*, a suction dredge with a single "Edwards" 20-inch centrifugal pump, has been put in first-class order, and a quarter boat provided for its crew. The capacity of the dredge is small--only one-half that of dredges *Nos. 3* and *4*—but it is capable of good work within that capacity, and should be retained for service until the new dredges are secured. Although ready for work during the low-water season, the services of this dredge were not required.

Dredges *Nos. 3* and *4* were in commission and in service during the fall, as has been stated. They have been made ready for service again, and are in good condition with the exception of the casings of the main dredging pumps, which are worn and cracked. These casings have been relined and strengthened, and will serve through the coming season, after which they will be replaced by new pumps, for which the designs are prepared. On account of delay which might arise in the delivery of the new pumps it was thought best not to risk changing the machinery with the dredging season so near at hand.

The alteration of the suction heads to dredge going forward or backward and to admit dredging to greater depths than at present is well under way at the shops at the engineer depot, and the changes will be effected this season if it can be done without interfering with the operation of the vessels.

The pipe lines and pontons for these dredges were cleaned and painted.

The designs for two new dredges of Kappa (M. R. C.) type, with 32-inch centrifugal pumps, are in hand, and the main features of the plan settled upon.

Pile drivers.—The full complement of drivers belonging to this office is 28. Of these, 20 are in good condition and ready for service, 2 of these having been rebuilt during the year. Five other drivers are in need of extensive repairs, and all of these are on the ways in preparation therefor. Another driver (old and in bad condition) was sunk in the spring, and after being raised was found so badly injured as to be upworthy of repair. It has been condemned and dismantled. The hull may be used for one or two seasons more as a field store boat. The 2 pile drivers remaining to be accounted for are in the possession of the Mississippi River Commission, at Memphis, Tenn., having been loaned to the Commission several years ago.

Derrick boats.—Of these there are two, both in good condition, *No. 2* having been thoroughly repaired during the year.

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Derrick barge.—Is entirely worn-out, and need not be replaced now. The hull should be rebuilt and revert to barge service, and the boilers should be sold. The derrick timbers are rotten, and have been taken down. The hoisting engines are good.

Barges.—There are 61 model available material barges in possession of this office, exclusive of the hulls of dredges *Nos. 1* and *2*, the derrick barge, and the store boat. Of these, 40 are in good condition for any loads and 21 are available for light service. Of the latter, 10, built in 1895, will soon require very thorough overhauling, and the remaining 11, which were rebuilt in 1898–99, are in somewhat better condition. During the year all barges requiring it received the ordinary repairs, four were rebuilt, and two are now on the ways undergoing repair.

Barge flats.—There are two barge flats, received by purchase from the Missouri River Commission. One of them, the better, *No. 4*, was rebuilt, and is in use as a wharf boat. The other has been condemned, and will be cut down and used as a hull upon which to mount a steam hammer.

Quarter boats.—There are 10 quarter boats. All have been serviceable throughout the year, although several require repainting, and 3 are now in such bad condition that the hulls should be rebuilt.

Office and survey boats.—These are 5 in number, of which 2 were rebuilt during the year and 2 more require similar repairs within the next year.

Flats, wood.—There are 103 flats on hand, of which 60, built in 1899, are in good condition. The remainder will require extensive repairs to fit them for use. The number available is much too small for a season of active operations of hurdle construction and bank revetment. Ninety flats were repaired and calked during the year.

Flats, steel.—There are 8 mattress way flats of steel, all new and in good condition.

Small boats.—Repairs were made to 8 yawls and 41 skiffs. There are 26 yawls and 127 skiffs on hand, all in fair condition with exception of about 20 of the skiffs.

Tools and appliances, boarding outfit, office furniture, etc.—Were kept in repair and small additions were made to each class to replace articles worn-out and condemned.

Engineer depot.—The shop buildings have been extensively rebuilt with steel frame work covered with corrugated sheet metal, all from old materials on hand, and the old worn-out buildings of wood have been condemned and removed. The following are the new buildings: Sawmill, coal and iron shed, paint and oil house with concrete floor, shop for sheet-iron work, and a shipping platform, the latter with calked deck beneath which is a skiff and tool shed with a cinder and spalls floor. Tanks have been made of old boilers for carrying creosote oil for use in the preservation of boat timbers, and an open treating tank has been installed in which the lumber has been successfully treated. The use of the open-tank process avoids the cost of a pressure plant, but the time of treatment is greatly increased.

MATERIALS.

Of the materials required for construction works the following amounts were procured by contract:

Piles, 9,232 sticks	linear feet..	386,713
Mattress lumber	feet B. M..	5,745,299
Stone	cubic yards..	56,206

The remainder of the piles, 1,754 sticks, 72,350 linear feet, were bought in open market, and the remainder of the stone, 94,631 cubic yards, was procured by hired labor at the quarries at Little Rock Landing, Mo.

At the close of the year 3,278 sticks, 133,504 linear feet of pile timber, and 571,615 feet B. M. of mattress lumber were on hand for future use, and all contracts for such supplies were closed.

QUARRIES.

Owing to the difficulty of getting stone from contractors at reasonable rates and in the vicinity of works of improvement, this office, in 1892, opened quarries at Little Rock Landing, Mo., and has operated them ever since upon payment of royalty to the owners upon the output, thus supplying the stone required over and above that which could be cheaply and readily bought from private parties.

The quarries are two in number, adjoining and having a combined river front of about 1 mile, and are now well equipped with boilers, steam drills, tracks, cars, derricks, tools, shops, and quarters, but the face of the cliff is worked back from the river to such a distance that the use of a central power plant for compressed air for drills and machinery will conduce to marked economy of operations if the quarries are to be used as extensively as heretofore.

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The lower quarry has been worked most, but the owner has signified his unwillingness to renew or extend the agreement under which it is now operated, and, if this determination on his part is final, the shops, quarters, etc., now on a part of his property under rental, must be moved by September 16, the date of expiration of the lease, and the tracks, derricks, and all other property belonging to the United States must be removed from the quarry proper by December 31, although until the latter date the quarry may be operated.

The owner of the upper quarry, with its less worked and much larger body of stone, has agreed to extend his lease for five years from January 1, 1906.

During the fall season both quarries were operated and during the spring the lower quarry only, and upon a reduced scale, until the suspension of work.

During the year, 94,628 cubic yards of stone were thus procured, of which the slightly larger portion was from the lower quarry.

Both quarries are now stripped, exposing 30 feet of the ledge, or for about the output for another year. No stripping has been done during the past spring season.

PHYSICAL DATA.

Gauges.—There are 16 river gauges within the district, established and maintained by this office, which have been read daily by appointed observers, two of whom are employees upon other work. Reports are also received from two gauges maintained by the St. Louis Water Department, and from two which are under the Mississippi River Commission.

These 20 gauges are placed at intervals of from 3 to 13 miles apart, between the Chain of Rocks, near the Missouri River, and the mouth of the Ohio River.

Discharge observations.—Fifty-six measurements of the discharge of the river were made at the engineer depot, St. Louis, throughout the fall season, July to December, with full-depth rod floats at stages below 25 feet, completing an annual oscillation of the river at that point. Five measurements above that stage were made at Chester, Ill., for determination of extreme high-water discharge.

The results of this series (for the calendar year 1904) and of those for 1903 and 1900–1901, are shown in the accompanying diagrams,[a] in which all the elements of the measurements have been plotted, as well as the resulting curves showing the volumes of discharge, velocities, and areas of cross section for gauge heights at St. Louis, but the data is as yet too meager to throw much light upon the question of the lowering of the slope of the river due to works of improvement, which the observations are intended ultimately to solve.

The observations were discontinued at the beginning of January, with the intention to repeat them at intervals of a few years until the data required has been accumulated.

There is also forwarded a hydrograph of the mean and extreme readings of the St. Louis gauge for the past forty-four years, which may fairly be said to represent the normal conditions of the river.

By your direction, in the fall of 1903, immediately at the close of the season, a line of channel soundings was run from Cairo to Little Rock, 126 miles, where it was stopped because of the ice, although the intention was to have carried the line through to the mouth of the Missouri River, 70 miles farther. Unfortunately, also, the river at the time was at a stage about 3 feet above standard low water, so that the results are probably not quite such as would have been obtained with the river in a more normal low-water condition.

The profile[b] from these soundings is shown on the accompanying plate, from which a calculation has been made of the amount of material to be moved ordinarily (by dredges or permanent works) to secure at low water the desired depths of a channel 300 feet wide on the bottom and with side slopes of 4:1, throughout the district. The quantity is 3,500 cubic yards per mile for 16 miles above St. Louis, and 4,700 cubic yards per mile below that city, for the proposed navigable depths of 6 feet and 8 feet, respectively, below standard low water.

The remarkable fact will be noted on this diagram that the average depth of water, throughout the district, at a stage of 6.6 feet on the St. Louis gauge, is nearly 25 feet.

Very respectfully, your obedient servant,

WM. S. MITCHELL,
Assistant Engineer.

Maj. THOS. L. CASEY,
Corps of Engineers.

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[a] Three only are printed. [b] Not printed.

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Measurements of discharge of the Mississippi River by rod floats, 1904–5.

Dates.	Localities.	St. Louis gauge 0=166.26 feet above St. Louis datum.	Elevations of water surface above St. Louis datum.		Oscillations.	Width of waterway.	Area of entire cross section.	Mean depth.	Elevation of mean bottom above St. Louis datum.	Total volume of discharge.	Mean velocity.	Number of stations.
			St. Louis gauge.	Local gauge.								
1904.		*Feet.*	*Feet.*	*Feet.*		*Feet.*	*Sq. feet.*	*Feet.*	*Feet.*	*Cu. feet per sec.*	*Feet per sec.*	
July 1	Foot of Arsenal street, St. Louis, Mo	24.2	190.4	188.9	F	2,607	75,479	28.9	160.0	391,854	5.19	14
6	do	21.6	187.8	186.5	F	2,569	68,299	26.6	159.9	308,262	4.51	14
8	do	21.1	187.3	185.9	R	2,557	64,782	25.3	160.6	294,844	4.55	14
12	Chester, Ill	28.4	194.6	150.7	R	2,701	91,906	34.0	116.7	515,256	5.61	13
13 a. m.	do	28.3	194.5	151.1	R	2,701	94,384	34.9	116.1	513,314	5.44	15
13 p. m.	do	28.2	194.5	151.1	S	2,702	94,209	34.9	116.2	529,980	5.63	14
14	do	27.2	193.5	150.9	F	2,701	93,803	34.7	116.1	504,281	5.38	18
15	do	25.8	192.0	150.1	F	2,702	91,514	33.9	116.2	475,052	5.19	17
18	Foot of Arsenal street, St. Louis, Mo	21.5	187.7	186.4	F	2,563	67,348	26.3	160.1	310,217	4.61	14
21	do	20.3	186.6	185.2	F	2,547	61,122	24.0	161.2	270,869	4.43	14
22	do	19.0	185.3	184.0	F	2,544	61,946	24.4	159.7	263,619	4.26	13
25	do	17.2	183.5	182.5	S	2,520	56,419	22.4	160.2	231,789	4.11	14
27	do	16.5	182.8	181.7	F	2,501	54,940	22.0	159.8	219,468	3.99	14
29	do	14.7	180.9	180.0	F	2,493	50,575	20.3	159.8	193,360	3.83	14
Aug. 1	do	12.9	179.2	178.3	F	2,482	45,760	18.4	159.9	165,952	3.63	14
4	do	11.8	178.0	177.2	F	2,474	44,034	17.8	159.4	148,116	3.36	14
5	do	11.6	177.8	177.0	F	2,473	43,600	17.6	159.4	147,736	3.39	14
9	do	10.0	176.2	175.2	F	2,456	39,080	15.9	159.3	121,321	3.11	13
10	do	9.6	175.8	174.7	F	2,454	37,582	15.3	159.4	115,145	3.07	13
12	do	8.4	174.7	173.9	F	2,453	36,872	15.0	158.9	109,384	2.97	14
16	do	8.2	174.4	173.8	R	2,455	37,743	15.4	158.5	110,867	2.94	14
17	do	8.5	174.7	174.1	S	2,456	38,580	15.7	158.4	114,906	2.98	14
22	do	11.2	177.5	176.7	F	2,472	44,163	17.9	158.8	147,749	3.35	14
24	do	12.4	178.6	177.9	F	2,480	47,289	19.1	158.8	162,594	3.44	14
26	do	12.5	178.8	178.0	R	2,487	48,256	19.4	158.6	171,368	3.55	14
29	do	10.0	176.3	175.6	F	2,466	40,807	16.6	159.1	129,754	3.18	14
31	do	8.3	174.5	173.9	F	2,456	37,067	15.1	158.8	109,861	2.96	14
Sept. 1	do	7.7	174.0	173.4	F	2,458	36,071	14.7	158.7	105,775	2.93	14
6	do	7.7	173.9	173.3	F	2,454	36,055	14.7	158.6	106,719	2.96	14
7	do	7.2	173.5	172.9	F	2,454	32,755	13.4	159.5	94,406	2.88	14
10	do	6.8	173.0	172.5	R	2,442	33,848	13.9	158.6	95,896	2.83	14
12	do	6.8	173.0	172.5	F	2,442	31,721	13.0	159.5	89,623	2.83	13
20	do	9.6	175.9	175.2	R	2,466	39,599	16.1	159.1	129,016	3.26	14
21	do	11.1	177.4	176.7	R	2,475	43,518	17.6	159.2	151,037	3.47	13
24	do	9.6	175.8	174.4	F	2,468	41,012	16.6	158.8	127,190	3.10	12
28	do	10.9	177.2	176.5	S	2,475	45,798	18.5	158.0	148,905	3.25	14
29	do	11.0	177.2	176.6	R	2,475	44,924	18.2	158.4	146,047	3.25	14
Oct. 3	do	10.7	176.9	176.3	F	2,476	44,144	17.8	158.4	142,065	3.22	14
7	do	8.8	175.0	174.5	S	2,461	38,232	15.5	158.9	116,858	3.06	13
11	do	7.8	174.1	173.6	F	2,458	36,587	14.9	158.7	108,020	2.95	18
12	do	7.7	173.9	173.4	F	2,460	36,964	15.0	158.4	109,766	2.97	13
17	do	6.7	173.0	172.4	S	2,445	34,217	14.0	158.4	94,094	2.75	19
18	do	6.7	173.0	172.4	F	2,445	34,741	14.2	158.1	95,188	2.74	19
24	do	7.1	173.4	172.8	R	2,451	34,869	14.2	158.6	99,033	2.84	17
26	do	7.7	174.0	173.4	R	2,459	36,881	15.0	158.4	106,978	2.90	18
Nov. 1	do	9.9	176.1	175.5	S	2,478	41,789	16.9	158.7	132,024	3.16	20
2	do	9.7	176.0	175.4	S	2,478	42,330	17.1	158.3	131,952	3.12	18
7	do	8.9	175.2	174.6	F	2,467	40,580	16.5	158.2	119,074	2.93	18
22	do	6.5	172.7	172.1	F	2,433	33,189	13.6	158.5	91,015	2.74	14
23	do	6.3	172.5	172.0	F	2,428	33,888	14.0	158.0	90,855	2.68	17
26	do	5.6	171.9	171.3	F	2,421	31,561	13.0	158.3	85,286	2.70	19
28	do	5.3	171.6	170.9	S	2,420	31,065	12.8	158.1	79,885	2.57	17
30	do	5.1	171.4	170.8	F	2,421	30,115	12.4	158.4	79,876	2.65	19
Dec. 5	do	4.3	170.6	170.1	F	2,416	29,320	12.1	158.0	75,782	2.58	15
6	do	4.3	170.5	170.1	F	2,415	30,047	12.4	157.6	73,357	2.44	17
8	do	3.8	170.0	169.4	F	2,415	28,205	11.7	157.7	69,210	2.45	18
9–10	do	3.7	169.9	169.3	S	2,416	28,113	11.6	157.7	69,248	2.46	18
20	do	0.5	166.8	166.2	F	2,375	21,179	8.9	157.3	42,830	2.02	16
21	do	0.4	166.7	166.0	F	2,372	20,950	8.8	157.2	42,589	2.03	17
22	do	0.2	166.5	165.9	F	2,372	20,346	8.6	157.3	39,196	1.93	16
1905.												
Jan. 3	do	1.5	167.8	167.2	R	2,399	23,288	9.7	157.5	53,830	2.31	13

Zero Engineering Department gauge, foot of Arsenal street, is 165.91 feet, St. Louis datum.
Zero, Chester, Ill., gauge is 127.29 feet, St. Louis datum.

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O W. Q. Casey
Major Corps of Engineers U.S.A.

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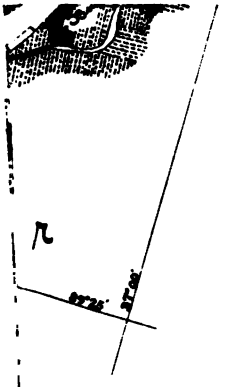

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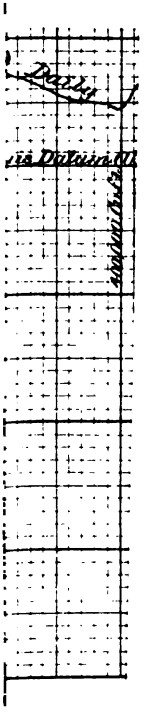

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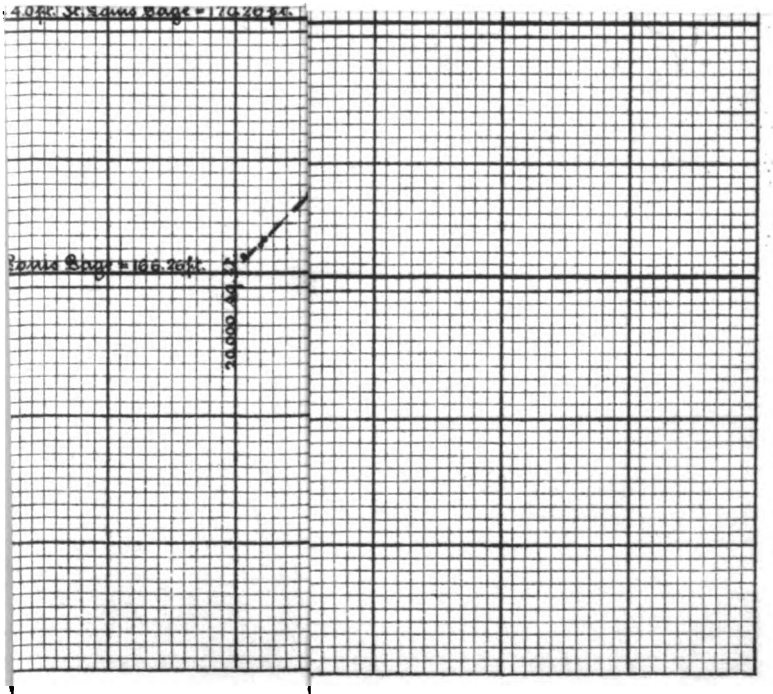

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APPENDIX Y.

OPERATING SNAG BOATS AND DREDGE BOATS ON UPPER MISSISSIPPI RIVER; IMPROVEMENT OF MISSISSIPPI RIVER BETWEEN MOUTH OF MISSOURI RIVER AND ST. PAUL, MINNESOTA, AT MOLINE, ILLINOIS, AND OF LA CROSSE HARBOR, WISCONSIN; OPERATING AND CARE OF GALENA RIVER IMPROVEMENT, ILLINOIS, AND OF ILLINOIS AND MISSISSIPPI CANAL AROUND THE LOWER RAPIDS OF ROCK RIVER, ILLINOIS.

REPORT FOR THE FISCAL YEAR ENDING JUNE 30, 1905, WITH OTHER DOCUMENTS RELATING TO THE WORKS. OFFICERS IN CHARGE, MAJ. JAS. L. LUSK AND MAJ. C. S. RICHÉ, CORPS OF ENGINEERS.

IMPROVEMENTS.

1. Operating snag boats and dredge boats on upper Mississippi River.
2. Mississippi River between mouth of Missouri River and St. Paul.
3. Operating and care of Des Moines Rapids Canal and Dry Dock.
4. Mississippi River at Moline, Illinois.
5. Operating and care of Illinois and Mississippi Canal around the lower rapids of Rock River, at Milan, Illinois.
6. Operating and care of Galena River Improvement, Illinois.
7. Harbor at La Crosse, Wisconsin.

HARBOR LINES.

8. Mississippi River at Hannibal, Missouri.

UNITED STATES ENGINEER OFFICE,
Rock Island, Ill., July 12, 1905.

GENERAL: I have the honor to transmit the annual report on improvement work in this district for fiscal year ending June 30, 1905.

Maj. Jas. L. Lusk, Corps of Engineers, was in charge of this district from July 1 to 18, 1904, and from October 18, 1904, to March 31, 1905.

Very respectfully, your obedient servant,

C. S. RICHÉ,
Major, Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

Y 1.

OPERATING SNAG BOATS AND DREDGE BOATS ON UPPER MISSISSIPPI RIVER.

The work performed under this appropriation consists chiefly in the removal of snags, wrecks, rocks, and other obstructions to navigation. The operations extend from Minneapolis to the mouth of the Mis-

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souri River, a distance of about 670 miles following the low-water channel.

There belongs to this work the snag boat *Col. A. Mackenzie*, built in 1900; but dredges, drill boats, and tenders are borrowed from other works when required. The general improvement of the river has so reduced the extent of caving banks (which are the principal source of snags) that but one snag boat is needed.

The details of work accomplished are given in the appended report of Principal Assistant Engineer C. W. Durham.

The total tonnage of the river between Falls of St. Anthony and mouth of Missouri River for the calendar year 1904 was approximately 4,534,539 tons, and the ton-miles 943,951,451. This includes logs and lumber.

Money statement.

June 30, 1905, amount drawn from Treasury under permanent appropriation	$25,000.00
June 30, 1905, amount expended during fiscal year	25,000.00
July 1, 1905, amount available under permanent appropriation of August 11, 1888, for fiscal year ending June 30, 1906	25,000.00

ABSTRACT OF APPROPRIATIONS AND ALLOTMENTS.

By act approved March 2, 1867	$96,000	By act of August 11, 1888, for fiscal year ending—	
By allotment from appropriation of July 25, 1868	26,000	June 30, 1889	$25,000
By allotment from appropriation of 1869	35,640	June 30, 1890	25,000
By act approved—		June 30, 1891	25,000
July 11, 1870	36,000	June 30, 1892	25,000
March 3, 1871	42,000	June 30, 1893	25,000
June 10, 1872	42,000	June 30, 1894	25,000
March 3, 1873	25,000	June 30, 1895	25,000
June 23, 1874	25,000	June 30, 1896	25,000
March 3, 1875	25,000	June 30, 1897	25,000
August 14, 1876	30,000	June 30, 1898	25,000
June 18, 1878	41,500	June 30, 1899	25,000
March 3, 1879	20,000	June 30, 1900	24,944
June 14, 1880	8,000	June 30, 1901	25,000
March 3, 1881	25,000	June 30, 1902	25,000
By act passed August 2, 1882	25,000	June 30, 1903	25,000
By act approved August 5, 1886	22,500	June 30, 1904	25,000
		June 30, 1905	25,000
		Total	949,584

STATISTICS OF COMMERCE AND NAVIGATION.

Lumber.—The most important business at present carried on in connection with the navigation of the upper Mississippi River and its principal tributaries is the lumber trade, which gave employment in 1904 to about 50 raft boats, which distributed logs from the upper waters to the various mills scattered along the river from Minneapolis to St. Louis, and also brought down, chiefly to points below the Des Moines Rapids, much lumber from the St. Croix River. The manufactures of these mills in 1904 were: White pine lumber, 772,157,000 feet B. M.; shingles, 62,542,000; laths, 138,231,000, and hemlock lumber, 14,900,000 feet B. M.

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Lumber manufacture, upper Mississippi River Valley, 1904.

[Value, about $36,500,000.]

Locality.	Lumber.	Shingles.	Laths.
	Feet B. M.	*Number.*	*Number.*
Above Minneapolis	544,056,000	92,457,000	121,420,000
Minneapolis	386,911,000	82,063,000	53,552,000
St. Paul to Missouri River	385,246,000	30,479,000	84,679,000
St. Croix River	173,182,000	19,691,000	53,569,000
Chippewa River	97,214,000	47,500,000	13,994,000
Total	1,586,609,000	222,190,000	327,214,000

The larger part of the above was floated for greater or less distance on the Mississippi River, either as logs or lumber.

Steamboats and freight.—There were employed, between St. Paul and St. Louis during 1904, 50 raft boats, 20 packets, 33 towboats, 17 ferryboats, 60 pleasure boats, and 20 Government boats; in all, 200 steamboats, with a gross tonnage of about 18,000 tons.

The principal steamboat lines on the upper Mississippi River are the Diamond Jo, the Eagle, the Carnival City, and the Acme Packet companies. The number of passengers carried by all boats, including the ferries, in 1904, was 1,463, 210. The quantity of freight carried by all boats, including the rock and brush loaded on barges and used in Government work, and also including logs and lumber floated down the stream, i s shown in the following table, together with the ton-miles and approximate valuation.

Upper Mississippi River freight statement for 1904.

Designation.	Tons.	Ton-miles.	Valuation.
Logs	2,833,405	796,685,300	$12,652,520
Rafted lumber, shingles, etc	267,786	110,063,790	3,518,332
Miscellaneous freight	1,144,932	33,538,789	18,324,100
United States material	288,466	3,663,572	171,501
Total	4,534,589	943,951,451	34,666,453

The following table affords a view of the amount of navigation at various localities on the upper Mississippi River for the year 1904:

List of steamboats, barges, and rafts passing through various bridges.

Locality of bridge.	Miles from St. Paul.	Steamboats.	Barges.	Rafts.
St. Paul Park	11	1,372	181	304
Hastings	28	1,423	222	461
Prescott	30	2,427	(a)	(a)
Reeds	78	1,421	458	304
Winona	116	2,423	875	740
La Crosse	143	1,994	766	314
Dubuque	265	1,098	749	276
Sabula	310	1,058	694	196
Clinton	327	2,097	648	(a)
Rock Island	363	2,175	618	215
Keithsburg	417	784	260	69
Burlington	441	1,233	439	74
Fort Madison	462	1,184	276	53
Keokuk	484	b1,198	b506	b24
Quincy	521	1,210	644	12
Hannibal	540	473	116	4
Louisiana	568	1,243	270	(a)
Alton	652	1,602	196	9

a No record. b Partial record.

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Internal revenue for the year ending December 31, 1904, collected in districts bordering on the upper Mississippi River.

District.	Office.	Amount.
Minnesota	St. Paul	$1,425,485.69
Second Wisconsin	Madison	831,235.75
Third Iowa	Dubuque	389,726.02
Fourth Iowa	Burlington	456,941.91
Fifth Illinois	Peoria	34,939,629.39
Eighth Illinois	Springfield	9,577,576.80
Thirteenth Illinois	East St. Louis	884,362.53
First Missouri	St. Louis	7,468,915.16
Total		55,973,873.25

Customs revenue and tonnage for the year ending December 31, 1904.

Port.	Collections.	Tonnage enrolled.	Vessels.
St. Paul, Minn	$725,126.33	3,553	51
La Crosse, Wis	16.86	2,159	36
Dubuque, Iowa	14,409.33	987	20
Rock Island, Ill	14.48	6,265	121
Burlington, Iowa	59.74	2,672	41
St. Louis, Mo.[a]	2,051,592.80	25,849	115
Total	2,791,219.54	41,485	384

[a] Only a part of the St. Louis statement is applicable to the upper Mississippi.

Summary of expenditures for operating snag boats and dredge boats on upper Mississippi River for fiscal year ending June 30, 1905.

Month.	Office expenses, superintendence, and contingencies.	Care, repair, and operating snag boats and dredge boats.						Grand total.
		Labor.	Subsistence.	Fuel.	Expense.	Repairs.	Total.	
1904.								
July	$150.00	$1,392.50	$376.68	$277.56	$252.55	.....	$2,299.29	$2,249.29
August	.....	120.00	483.60	598.35	523.14	.....	1,725.09	1,725.09
September	304.25	3,429.84	303.23	555.00	1.50	$7.08	4,296.15	4,600.40
October	.....	855.17	432.61	975.35	94.00	13.20	2,370.33	2,370.33
November	304.27	3,525.11	513.17	723.66	141.16	32.82	4,935.92	5,240.19
December	167.06	265.00	.....	.....	.....	.....	265.00	432.06
1905.								
January	.....	392.77	.....	.....	.....	.....	392.77	392.77
February	.....	265.00	.....	.....	.....	62.64	327.64	327.64
March	.....	325.00	.....	.....	.....	122.81	447.81	447.81
April	.....	559.67	.....	.....	.....	753.36	1,313.03	1,313.03
May	4.27	.....	486.86	209.95	68.41	275.35	1,040.57	1,044.84
June	129.00	3,261.70	307.92	560.76	332.20	64.97	4,527.55	4,656.55
Total	1,058.85	14,891.26	2,904.07	3,900.63	1,412.96	1,332.23	23,941.15	25,000.00

REPORT OF MR. C. W. DURHAM, PRINCIPAL ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Rock Island, Ill., July 1, 1905.

MAJOR: I have the honor to present my report on the operations of snag boats and dredge boats on the upper Mississippi River for the fiscal year ending June 30, 1905.

Operations of snag boat Col. A. Mackenzie.—The *Mackenzie* was employed from July 1 to November 4, 1904, in removing snags and other obstructions, placing buoys, making surveys, and otherwise assisting the interest of navigation between Minneapolis and the mouth of the Missouri River.

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Leaving St. Paul July 1, she proceeded down river, arriving at St. Louis (676 miles) on the 15th, and thence returning up river, reached St. Paul on the 27th. On this round trip, in addition to removing obstructions at many localities, she towed dredge *Hecla*, with her 10 pontons and 3 barges, from Quincy to Keokuk; towed building barge *No. 208* from Keokuk to Rock Island, and placed 2 mooring rings at the Louisiana steamboat landing.

The *Mackenzie* again left St. Paul July 29, arrived at St. Louis August 12, and returned to St. Paul August 25. On this round trip many snags and other obstructions were removed, a survey of the river above Keithsburg bridge was made, and a portion of the Flint Creek levee was inspected.

From September 24 to October 4, 1904, the *Mackenzie* was used by Col. O. H. Ernst, division engineer, Northwestern Division, in inspecting the improvement work between St. Paul and the mouth of the Missouri River, special attention being paid by a board of army engineers to river conditions in the vicinity of Guttenberg and Glenhaven.

The *Mackenzie* again left St. Louis for up river October 5, and turning back at La Crosse on October 23, reached St. Louis November 10; thence she returned up river to the Des Moines Rapids Canal, where she was laid up for the winter, above the middle lock, on November 14. On this trip, in addition to the removal of numerous obstructions, she towed towboat *Viren* from Parsons bar and 1 dump from Rock Island to the Des Moines Rapids Canal, and also towed dredge *Vulcan*, 2 dumps, and 3 barges from Keithsburg to Rock Island. The boilers of the wrecked steamboat *Flying Eagle*, lying near Hannibal, were removed and placed on the Missouri shore.

In 1905 the *Mackenzie*, having been repainted and otherwise repaired, left her winter quarters on May 12, and from that date until the end of the month she was employed in removing snags and other obstructions and placing buoys between Keokuk and St. Paul. On May 24 and 25 a survey of Galena River and Harris Slough was made.

Leaving St. Paul June 2, she reached St. Louis on the 16th, and returning up river arrived at Rock Island June 28, and remained there until the end of the fiscal year. On this trip many obstructions were removed, but the work was much interfered with by high water.

Summary.

Snags removed	278
Stumps destroyed	61
Leaning trees pulled back	55
Large trees felled (over 8 inches diameter)	901
Small trees felled (under 8 inches diameter)	474
Bowlders removed	2
Steamboats assisted	1
Buoys placed	17
Mooring chains placed	3
Surveys, days	2½
Miles run	7,719

Operations of dredge Vulcan.—An extensive bar at Fulton prevented the landing of steamboats. U. S. dredge *Vulcan*, with tender *Mac* and single crew, was employed from September 5 to 22, 1904, in giving temporary relief. The area covered by the dredge was 62,250 square feet, going down to a grade of 5½ feet below low water wherever rock did not prevent. There was dredged 8,602 cubic yards of sand at a cost of $870.47, or 10 cents per yard. No thorough and permanent improvement of this harbor can be made without a large expenditure of money.

To aid in the formation of a new channel above Keithsburg bridge, dredge *Vulcan*, with tender *Emily* and single crew, was employed from September 24 to October 27, 1904, in dredging across the bar. Four cuts were made with a grade of 6 feet below low water, and two with a grade of 8 feet. The area worked over was 134,600 square feet, and the material removed, consisting of sand, was 20,136 cubic yards, at a cost of $1,639.16, or 8 cents per cubic yard.

Operations of dredge Phoenix.—U. S. dredge *Phoenix*, with tender *Stella* and double crew, was engaged from September 12 to October 14, 1904, in removing various obstructions between Keokuk and Turners landing. During the period mentioned she removed 1 stump from the Keokuk landing; a wrecked piece of shore protection, 500 feet in length, near Fox River; 20 snags from head of Curtis Island; 2 snags from opposite foot of La Grange Island; a portion of the old shore protection in the bar at Quincy; 10 snags from edge of channel just below Clarksville; portions of trailer, wing dams, and shore protection opposite Turners landing, and a part of the

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machinery of the wreck of the *Flying Eagle*, near Hannibal. The cost of the above-mentioned work was $1,961.56.

From May 24 to June 6, 1905, the *Phoenix* was employed in removing deposits from the Keokuk steamboat landing. There were removed 4,047 cubic yards of sand and mud, at a cost of $497.38, or 12 cents per yard.

Summary of expenditures.

Snag boat *Col. A. Mackenzie*, operating	$18,972.58
Dredging at Fulton Harbor	870.47
Dredging above Keithsburg bridge	1,639.16
Dredging and removing wrecks, etc., between Keokuk and Turners Landing	1,961.56
Dredging at Keokuk steamboat landing	497.38
Superintendence and office expenses	1,058.85
Total	25,000.00

Very respectfully, your obedient servant,

C. W. DURHAM,
Principal Assistant Engineer.

Maj. C. S. RICHÉ,
Corps of Engineers.

Y 2.

IMPROVEMENT OF MISSISSIPPI RIVER BETWEEN MOUTH OF MISSOURI RIVER AND ST. PAUL.

The work performed under this appropriation consists chiefly in the permanent improvement of through navigation, but improvements at harbors and other localities are frequently made under allotments contained in the various acts of Congress.

The original condition of the channel between the Missouri River and St. Paul was such that at low stages the larger boats were unable to proceed farther up the river than La Crosse or Winona, while at extreme low water navigation was impeded at points much lower. The original project for improvement, which has undergone no material change, was adopted in 1878, and contemplates the closure of chutes, revetment of caving banks, and contraction of the channel by wing dams, so as to obtain a channel of a depth of 4½ feet at low water, to be eventually increased to 6 feet.

At the close of the fiscal year ending June 30, 1905, there had been expended $11,286,757.11, which has resulted in such an improved condition of the channel as to permit the passage of the largest boats at very low stages through to St. Paul. It may be proper to state that of the amount above mentioned about $1,020,000 has been expended on harbor and levee work without much benefit to the main channel.

On July 1, 1904, there was unexpended $557,974.28. During the past year, for the improvement of through navigation, dam construction, shore protection, dredging, removal of rock, etc., have been carried on by hired labor and use of Government plant between St. Paul and Bellevue; at Rock Island Rapids, and between Quincy and the Missouri River, and by contract between Bellevue and Leclaire, and between Rock Island and Hamburg.

The balance available July 1, 1905, will be applied at such points as may seem most in need of improvement, by hired labor, between St. Paul and Savanna and between Hannibal and the Missouri River; by contract between Sabula and Leclaire, and between Rock Island and Hamburg.

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GENERAL IMPROVEMENT.

St. Paul to Winona.—By hired labor and use of Government plant, improvement work was carried on in 1904 at Point Douglas (mile 29), Beef Slough (mile 87), and in the vicinity of Minneiska (miles 97–100). Twenty-one wing and closing dams were built, and 5,520 linear feet of shore protection. Dredging was done at Island 49 (mile 100) and Island 36 (mile 87).

Winona to Wisconsin River.—In this division work was carried on in 1904 by hired labor and use of Government plant in the vicinity of Lamoille (mile 125), Dresbach (miles 136–139), Cottage Island (miles 140–141), below La Crosse (mile 148), below Genoa (mile 164), and at Bad Axe Bend (mile 167). Ten wing and closing dams were built, and 2,880 linear feet of shore protection. Several dams and pieces of shore protection were repaired. Similar work was resumed in 1905 in the vicinity of Dresbach Island (miles 139–140). All of the rock used in this division was furnished by the United States quarry at Lamoille.

Wisconsin River to Bellevue.—With hired labor and Government plant operations were carried on in this division in 1904 in the vicinity of Hurricane Island (miles 245–247) and Parsons Bar (miles 252–256). Nine wing and closing dams were built, and 5,615 linear feet of shore protection. Four dams were repaired. Mooring piles were driven at Dubuque ice harbor; and in June, 1905, dredging in that harbor was commenced.

Bellevue to Leclaire.—Under contracts with Fetter & Crosby and A. B. Teasdale, work was carried on in 1904 in the vicinity of Island 283 (miles 319–321), and fair progress was made. In 1905 work under contract with A. B. Teasdale was resumed at the above locality, but was much hindered by high water.

Rock Island Rapids.—Excavation and removal of rock from the channel (miles 348–364) were carried on during the fiscal year at Smiths, Sycamore, Campbells, Cottonwood, Moline, and Lower chains. Some repairs were made to dams and guide-pier foundations. The rapids improvement under approved project is now almost completed.

Rock Island to Burlington.—Under contract with Fetter & Crosby work was carried on in 1904 in the vicinity of Smiths Island (mile 370), Horse Island (mile 368), Montpelier (miles 377–378), Hershey Chute (miles 385–387), above Port Louisa (miles 402–403), and above Keithsburg Bridge (mile 417). In May and June, 1905, work in the latter locality completed the contract. Five dams were built and 5,420 linear feet of shore protection. Several dams and pieces of shore protection were raised, trimmed, and repaired. In June, 1905, under contract with Albert Kirchner, 2 wing dams were built and 1 closing dam repaired in the vicinity of Johnsons Island (mile 423).

Burlington to Hannibal.—Under contract with Albert Kirchner improvement work was carried on in 1904 in the vicinity of Alexandria and Fox Island (miles 490–493), near Curtis Point (mile 499), and at Quincy (miles 521–522). Three wing dams and 3,980 linear feet of shore protection were built, and several dams and pieces of shore protection were raised and repaired.

Hannibal to mouth of Missouri River.—In this division work was carried on in 1904 by hired labor and use of Government plant in the vicinity of Cuivre Island (mile 616), Iowa Island (miles 627–631),

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Grafton (mile 635), and Portage Island (miles 640–641). Six dams were built and 1,500 linear feet of shore protection. Several dams were repaired.

SPECIAL WORK.

Harbor of refuge at Pepin, Wis.—In May and June, 1905, operations in lengthening the pier (mile 74) were carried on by hired labor and use of Government plant. The full projected length of the pier has been attained and the work will soon be completed.

Money statement.

March 3, 1905, amount available	$11,500.00
June 30, 1905, amount expended during fiscal year	3,080.60
July 1, 1905, balance unexpended	8,419.40

ABSTRACT OF ALLOTMENTS.

By river and harbor act approved—	
June 13, 1902	$14,000
March 3, 1905	11,500
Total	25,500

Channel at Clinton, Iowa.—No work was done during the past year.

Money statement.

July 1, 1904, balance unexpended	$2,928.85
July 1, 1905, balance available	2,928.85

ALLOTMENT.

By sundry civil act of March 3, 1899	$25,000

Harbor of refuge below Davenport, Iowa.—In 1904 the dredging and the driving of mooring and protection piles was completed.

Money statement.

July 1, 1904, balance unexpended	$10,461.83
June 30, 1905, amount expended during fiscal year	7,161.34
July 1, 1905, balance unexpended	3,300.49

ABSTRACT OF ALLOTMENTS.

By sundry civil act of March 3, 1899	$10,000
By river and harbor act of June 13, 1902	5,000
Total	15,000

Harbor at Muscatine, Iowa.—No work was done during the year.

Money statement.

July 1, 1904, balance unexpended	$10,000.00
July 1, 1905, balance unexpended	10,000.00

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ABSTRACT OF APPROPRIATIONS AND ALLOTMENTS.

By river and harbor act of—	
March 3, 1879	$7,500
June 14, 1880	7,500
March 3, 1881	2,500
August 2, 1882	2,500
By sundry civil act of June 4, 1897	15,000
By river and harbor act of June 13, 1902	10,000
Total	45,000

Flint Creek to Iowa River levee.—An inspection was made, and the outflow valves were thoroughly repaired.

Money statement.

July 1, 1904, balance unexpended	$643.52
June 30, 1905, amount expended during fiscal year	200.00
July 1, 1905, balance unexpended	443.52

ABSTRACT OF ALLOTMENTS.

By sundry civil act of—	
March 2, 1895	$85,000
June 3, 1896	75,000
June 4, 1897	50,000
July 1, 1898	40,000
Total	300,000

Warsaw to Quincy levee.—No work was done during the year.

Money statement.

July 1, 1904, balance unexpended	$10,282.71
July 1, 1905, balance unexpended	10,282.71

ABSTRACT OF ALLOTMENTS.

By sundry civil act approved—	
March 2, 1895	$85,500
June 4, 1897	5,000
March 3, 1899	5,000
By river and harbor act approved June 13, 1902	10,000
Total	105,500

Bar at Quincy.—Considerable dredging was done on the bar by hydraulic dredge, the material being deposited i. oank and the bank protected with brush and rock.

Money statement.

July 1, 1904, balance unexpended	$22,517.78
June 30, 1905, amount expended during fiscal year	16,459.39
July 1, 1905, balance unexpended	6,058.39

ABSTRACT OF ALLOTMENTS.

By river and harbor act of June 30, 1896	$10,000
By sundry civil act of March 3, 1899	10,000
By river and harbor act of June 13, 1902	20,000
Total	40,000

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Channel and harbor at Hannibal, Mo.—Under contract, dredging to the amount of 24,610 cubic yards was performed.

Money statement.

July 1, 1904, balance unexpended	$4,449.87
June 30, 1905, amount expended during fiscal year	4,111.56
July 1, 1905, amount unexpended	338.31

ALLOTMENT.

By river and harbor act of June 13, 1902	$15,000

The details of the above-mentioned improvements are given in the appended reports of assistants in local charge.

Commercial statistics accompany my report on operating snag boats and dredge boats on the upper Mississippi River.

Summary of expenditures for calendar year ending December 31, 1904, for improving Mississippi River from mouth of Missouri River to St. Paul, Minn.

St. Paul to Winona	$58,736.89
Winona to Wisconsin River	56,094.35
Wisconsin River to Bellevue	54,457.04
Bellevue to Le Claire	37,591.87
Rock Island Rapids	30,591.31
Rock Island to Burlington	35,501.02
Burlington to Hannibal	54,427.80
Hannibal to Missouri River	47,698.90
Surveys and gauges	4,482.35
Construction, care, and repair of plant	49,868.26
Flint Creek to Iowa River levee	200.00
Harbor of refuge below Davenport	8,104.11
Warsaw to Quincy levee	176.49
Bar at Quincy	18,025.58
Channel and harbor at Hannibal	4,111.56
Total	460,067.53

NOTE.—In above statement the retained percentage on contracts December 31, 1904, is included.

General statement showing net expenditures from the commencement of improvement in 1878 to June 30, 1905, under various heads of appropriation.

St. Paul to Des Moines Rapids	$1,597,500.00
Minneapolis to Des Moines Rapids	1,100,000.00
Des Moines Rapids to Illinois River	1,330,000.00
Missouri River to Minneapolis	3,000,000.01
Missouri River to St. Paul	4,309,134.77
	11,336,634.78
Less amount transferred to work at Lock and Dam No. 2, Mississippi River, between Minneapolis and St. Paul, act of August 18, 1894	49,877.67
Total net expenditures	11,286,757.11
Balance July 1, 1905, Missouri River to St. Paul	521,727.82
Total appropriated	11,808,484.93

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Net expenditures on various sections of the river, harbors, levees, etc., between Minneapolis and the Missouri River from commencement of improvement to June 30, 1905.

Locality.	Distance.	Amount.	Per mile.
	Miles.		
St. Paul to Minneapolis	.....	$59,113.46	.....
St. Paul to Prescott	30	671,798.35	$22,393.00
Prescott to Lake Pepin	26	338,219.92	13,008.00
Foot of Lake Pepin to Alma	11	467,503.77	42,500.00
Alma to Winona Bridge (Chicago and Northwestern)	28	740,329.44	26,440.00
Winona Bridge to La Crosse Bridge (Chicago, Milwaukee and St. Paul)	28	744,609.47	26,600.00
La Crosse Bridge to McGregor Bridge	64	667,672.80	10,432.00
McGregor Bridge to Dubuque Bridge (Illinois Central)	57	440,012.35	7,719.00
Dubuque Bridge to Clinton Bridge (Chicago and Northwestern)	62	421,203.33	6,793.00
Clinton Bridge to Le Claire	21	39,830.24	1,897.00
Rock Island Rapids[a]	14	662,793.14	.....
Rock Island Bridge to Keithsburg Bridge	55	374,576.35	7,000.00
Keithsburg Bridge to Nashville	59	899,443.63	15,245.00
Keokuk Bridge to Quincy Bridge	37	584,700.18	15,800.00
Quincy Bridge to Clarksville	56	1,006,861.02	17,998.00
Clarksville to Cap au Gris	37	874,293.89	23,629.00
Cap au Gris to Illinois River	24	441,582.26	18,399.00
Illinois River to Missouri River	28	440,659.58	14,800.00
West St. Paul	.....	15,000.00	.....
Harbors of refuge in Lake Pepin:			
At Bay City	.....	1,000.00	.....
At Lake City[a]	.....	21,290.62	.....
At Stockholm[a]	.....	6,143.08	.....
At Kings Coulee	.....	30,000.00	.....
At Pepin	.....	17,080.60	.....
Fountain City Bay	.....	1,500.00	.....
Harbor at La Crosse[a]	.....	5,000.00	.....
Vicinity of Prairie du Chien	.....	30,000.00	.....
Harbors at Dubuque and East Dubuque[a]	.....	25,000.00	.....
Ice harbor at Dubuque[a]	.....	10,987.80	.....
Channel and harbor at Clinton	.....	22,071.15	.....
Harbor at Port Byron	.....	5,000.00	.....
Harbor at Rock Island[a]	.....	10,000.00	.....
Harbor of refuge at Davenport	.....	11,699.51	.....
Harbor at Muscatine[a]	.....	15,000.00	.....
Harbor at Burlington	.....	5,000.00	.....
Harbor at Montrose	.....	2,000.00	.....
Harbor at Quincy[a]	.....	13,180.98	.....
Bar at Quincy	.....	20,760.63	.....
Quincy Bay[a]	.....	84,481.36	.....
Channel and harbor at Hannibal	.....	14,661.69	.....
Harbor at Clarksville	.....	15,000.00	.....
Hamburg Bay	.....	10,000.00	.....
Flint Creek to Iowa River levee	.....	299,556.48	.....
Warsaw to Quincy levee	.....	95,217.29	.....
Sny Island levee	.....	106,728.99	.....
Surveys, gauges, and meter work	.....	237,316.70	.....
Snag boats, dredge boats, and wrecking	.....	82,093.35	.....
Practical test of Adams flume	.....	27,176.83	.....
Plant at estimated value	.....	171,656.87	.....
Total	.....	11,286,757.11	.....

[a] Amounts additional to those given above have been expended under special appropriations, as follows: Harbor at Stockholm, $25,000; Lake City Harbor, $20,000; La Crosse Harbor, $12,000; Dubuque and East Dubuque harbors, $41,000; ice harbor at Dubuque, $35,500; Guttenberg channel, $8,000; Rock Island Harbor, $12,000: Andalusia channel, $6,000: Muscatine Harbor, $20,000; Fort Madison Harbor, $24,100; Burlington channel and harbor, $30,000; Quincy Harbor, $15,000; Quincy Bay, $45,000; Hannibal channel and harbor, $45,000; Louisiana Harbor, $10,000; Alton Harbor, $108,000; vicinity of Alexandria, $16,000; La Crosse to Root River, $12,500; Rock Island Rapids, $1,166,650; Des Moines Rapids, $4,574,950; dry dock at Des Moines Rapids Canal, $125,000; total, $6,351,700.

The restoration of deteriorated works has been provided for from funds appropriated for general improvement, but this item has now become of such importance that a separate estimate of $40,000, based on the amount expended for repairs during the past fiscal year, is submitted for maintenance of improvement works.

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Money statement.

July 1, 1904, balance unexpended		$557,974.28
Amount appropriated by sundry civil act approved March 3, 1905		400,000.00
		957,974.28
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$376,246.46	
For maintenance of improvement	60,000.00	
		436,246.46
July 1, 1905, balance unexpended		521,727.82
July 1, 1905, outstanding liabilities		28,931.61
July 1, 1905, balance available		492,796.21
July 1, 1905, amount covered by uncompleted contracts		121,230.62
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$1,000,000.00	
For maintenance of improvement	40,000.00	
		1,040,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

ABSTRACT OF APPROPRIATIONS.

St. Paul to Des Moines Rapids:	
By act approved—	
June 18, 1878	$250,000.00
March 3, 1879	100,000.00
June 14, 1880	150,000.00
March 3, 1881	200,000.00
By act passed August 2, 1882	250,000.00
By act approved—	
July 5, 1884 (general improvement)	250,000.00
July 5, 1884 (applied to harbor, Lake City)	15,000.00
August 5, 1886	382,500.00
Minneapolis to Des Moines Rapids:	
By act of August 11, 1888	600,000.00
By act of September 19, 1890	500,000.00
Des Moines Rapids to Illinois River:	
By act approved—	
June 18, 1878	100,000.00
March 3, 1879	40,000.00
June 14, 1880	100,000.00
March 3, 1881	175,000.00
By act passed August 2, 1882	200,000.00
By act approved—	
July 5, 1884	200,000.00
August 5, 1886	150,000.00
By act of August 11, 1888	200,000.00
By act of September 19, 1890	165,000.00
Ohio River to Minneapolis, applied to "between Missouri River and Minneapolis:"	
By act approved—	
July 13, 1892	600,000.00
March 3, 1893 (sundry civil)	866,666.67
August 18, 1894 (sundry civil)	866,666.67
March 2, 1895 (sundry civil)	866,666.67

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Ohio River to St. Paul, applied to "between Missouri River and St. Paul:"	
By act of June 3, 1896	$200,000.00
By act of June 4, 1897 (sundry civil)	826,666.67
By act of July 19, 1897 (deficiency)	200,000.00
By act of July 1, 1898 (sundry civil)	826,666.67
By act of March 3, 1899 (sundry civil)	826,666.67
By act of June 6, 1900 (allotment)	150,000.00
Missouri River to St. Paul:	
By act approved—	
June 13, 1902	400,000.00
March 3, 1903 (sundry civil)	400,000.00
April 28, 1904 (sundry civil)	400,000.00
Received from sale of condemned property, 1904	862.58
March 3, 1905 (sundry civil)	400,000.00
Total	11,858,362.60
Less amount transferred to work at Lock and Dam No. 2, Mississippi River, between Minneapolis and St. Paul (act August 18, 1894)	49,877.67
	11,808,484.93

NOTE.—River and harbor act of March 3, 1905, appropriates $300,000 additional, which is not available until July 1, 1906.

List of contracts in force July 1, 1905, for improvement work on Mississippi River between mouth of the Missouri and St. Paul, Minn.

Name and residence of contractor.	Location of work.	Material in place.	Date of approval, of commencement of work, and expiration of contract.
		Per cubic yard.	
Fetter & Crosby, La Crosse, Wis.	Building dams and shore protections, Hannibal to Hamburg.	Rock, $1.40; brush, 55 cents.	Approved Aug. 29, 1904; work commenced May 2, 1905; contract expires Aug. 29, 1905.
A. B. Teasdale, Cassville, Wis.	Building dams and shore protections, Bellevue to Le Claire.	Rock, $1.24; brush, 35 cents.	Approved Sept. 28, 1904; work commenced Sept. 12, 1904; contract expires Sept. 28, 1905.
Albert Kirchner, Fountain City, Wis.	Building dams and shore protections, Rock Island to Burlington.	Rock, $1.39; brush, 51 cents.	Approved June 28, 1905; work commenced May 23, 1905; contract expires June 28, 1906.
Do	Building dams and shore protections, Burlington to Hannibal.	Rock, $1.44; brush, 51 cents.	Approved June 28, 1905; work not begun (July 1); contract expires June 28, 1906.

Comparative cost of material, 1904.

[Per cubic yard.]

Locality.	Rock.		Fascines.	
	In place.	On United States barges.	In place.	On United States barges.
St. Paul to Winona				$0.166
Reeds to Winona				.178
Alma to Winona				.167
Chimney Rock		$0.695		
Minneiska		.725		
Minneiska to Winona		.74		
Fountain City		.68		
Winona to Homer		.685		
Winona to Genoa				.16
Do				.19
Do				.159
Winona to Victory				.169
Do				.165

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Comparative cost of material, 1904—Continued.

Locality.	Rock.		Fascines,	
	In place.	On United States barges.	In place.	On United States barges.
Prairie du Chien to Waupeton				$0.165
Prairie du Chien to Dubuque				.20
Do				.18
Cassville		$.65		
Do		.595		
Cassville to Dubuque		.65		.179
Do				.17
Do				.1675
North Buena Vista		.62		
Buena Vista to East Dubuque				.1775
Waupeton		.62		
Spechts Ferry		.59		
Do		.615		
Do		.55		
Eagle Point to Bellevue		.62		
Dubuque to Bellevue				.165
Bellevue to Leclaire	$1.39		$0.56	
Do	1.24		.35	
Rock Island to Burlington	1.46		.58	
Do	1.42		.52	
Burlington to Hannibal	1.39		.58	
Do	1.35		.53	
Hamburg to Missouri River				.17
Stag Island to Turner Island				.175
Westpoint Landing		.65		
Do		.63		
Westpoint Landing to Grafton		.60		
Westpoint Landing to Alton				.17
Dardenne Island				.19
Grafton		.58		

NOTE.—The price per cubic yard of rock delivered on barges varied from 55 cents, at Spechts Ferry, to 74 cents, at Minneiska to Winona. The average cost of rock during the season was 64 cents.
The price per cubic yard of fascines varied from 15.9 cents, at Winona to Genoa, to 20 cents, at Prairie du Chien to Dubuque. The average cost of fascines during the season was 18 cents.

United States improvement, upper Mississippi River, St. Paul to Missouri River (Rock Island Rapids not included), 1878–1904.

[Including some desultory work done prior to 1878.]

Total length of dams (1,222,826 feet)	miles	231.6
Total length of shore protections (995,893 feet)	do	188.6
Dams:		
Total rock	cubic yards	3,630,223.4
Total brush	do	5,310,742.3
Total material	do	8,940,965.7
Average per linear foot, rock	cubic yards	2.97
Average per linear foot, brush	do	4.34
Average per linear foot, material	do	7.31
Shore protections:		
Total rock	cubic yards	1,725,685.6
Total brush	do	1,549,524.9
Total material	do	3,275,210.5
Average per linear foot, rock	cubic yards	1.73
Average per linear foot, brush	do	1.55
Average per linear foot, material	do	3.28
Grand total of material used	cubic yards	12,214,176.2

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Fuel statement, floating plant, season of 1904.

District.	Coal.	Average cost per ton.	Total cost.	Tow, mileage, and average cost for fuel.				Name of boat.	Hours per day.
				Days.	Per day.	Miles.	Per mile.		
	Tons.								
St. Paul to Winona.	1,866	$4.50	$6,147.00	145	$20.60	7,160	$0.42	Fury	12
				100	5.85	3,262	.18	Ada	12
				127	20.26			Geyser[a]	16
Winona to Wisconsin River.	774	3.55	2,749.01	114	14.26	5,281	.31	Alert	12
				105	10.70	4,601	.24	Elsie	12
Wisconsin River to Bellevue.	869	2.69	2,338.69	113	15.89	6,435	.28	Vixen	24
				109	2.38	1,548	.17	Louise	12
Rock Island Rapids, Illinois and Mississippi Canal; harbor below Davenport; dredging at Fulton and Keithsburg.	1,877	2.62	4,914.14	205	8.95	7,437	.11	Ruth	12
				198	3.62	4,680	.15	Mac	12
				145	3.84	4,867	.10	Emily	12
				59	2.22	587	.18	Louise	12
				201	1.99			Ajax[b]	8
				187	6.13			Vulcan[b]	8
				203	4.31			Dredge 103	16
Des Moines Rapids Canal and bar at Quincy.	2,298	2.34	5,377.63	88	12.26			Hecla and Stella	14
				120	22.86			do	16
Hannibal to Missouri River.	1,080	1.88	1,905.32	117	15.33	6,374	.28	Coal Bluff	24
Snag boat	1,402	2.74	3,885.82	214	17.92	8,473	.45	Mackenzie	12
Total	9,616	2.082	27,267.61						

[a] Pump dredge. [b] Dipper dredge.

Subsistence statement, season of 1904.

District.	Number of days subsisted.	Cost.		Average per day.	
		Raw.	Cooked and served.	Raw.	Cooked and served.
St. Paul to Winona, including dredging at Harriet Island, Island 36, and Island 49	10,787	$3,297.51	$4,659.34	$0.305	$0.431
Winona to Wisconsin River	18,010	5,828.21	7,298.12	.324	.405
Wisconsin River to Bellevue, including survey Guttenberg channel	10,598	2,909.99	3,918.25	.274	.369
Rock Island Rapids, including dredging and revetment Illinois and Mississippi Canal; harbor of refuge below Davenport, and dredging at Fulton and Keithsburg	15,434	4,060.80	6,421.17	.263	.416
Des Moines Rapids Canal; bar at Quincy; surveys, etc	8,680	2,283.82	3,334.26	.263	.384
Hannibal to Missouri River	7,345	1,795.78	2,528.10	.244	.344
Snagboat	6,269	2,642.85	3,352.85	.421	.535
Total	77,123	22,818.96	31,507.09	.296	.409

REPORT OF MR. J. D. DUSHANE, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
St. Paul, Minn., February 2, 1905.

MAJOR: I have the honor to submit the following report of operations for improvement of the Mississippi River between St. Paul and Winona (mile 116), the division in my local charge, for the calendar year 1904:

DREDGING CHANNELS.

The work of dredging was carried on by hired labor and use of Government plant. United States hydraulic dredge *Geyser* was employed, having been brought for the purpose from Rock Island, Ill., by towboat *Fury*.

At Harriet Island (mile 2).—During the high water of the preceding year a bar formed in the channel opposite the foot of Harriet Island above the Wabasha Strees Bridge. In order to preserve the position of the channel, with respect to the bridget

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and to prevent the movement of the bar down along the city front and the steamboat landing, it became necessary to dredge a cut through the bar. Work was begun May 10, 1904. A cut 1,400 feet long and 100 feet wide was made. The material removed, consisting of sand and small gravel, was deposited on the foot of Harriet Island. Work was temporarily suspended June 18 in order to move the dredge to Minneiska. The large quantity of mill refuse in the bar made the dredging difficult. Much time was lost on account of repairs to machinery and moving for passing boats and rafts. The actual running time of the dredge was 382 hours. The quantity of material dredged was 12,750 cubic yards. The dredge is equipped with a 10-inch Joseph Edwards sand pump; the suction and discharge pipes are 12 inches in diameter. The length of discharge line was 650 to 700 feet. The cost of the work, including $121.67 for general superintendence, $319.54 plant charge, and the cost of towing from Rock Island, $792.18, was $3,912.21.

At Island 49 (mile 100).—This dredging was done for the purpose of opening through the bar a new channel near Island 49. Dredge *Geyser* began work on June 20 and continued to July 30, when operations were temporarily suspended in order to move the dredge to the bar at the mouth of Beef Slough. Work was resumed at Island 49 on August 21 and continued to October 22, operations for the season then being suspended. Five cuts were made, varying in length from 300 to 1,200 feet, each 100 feet wide, and excavated to a depth of 10 to 12 feet below the low water of 1864. The material, consisting of sand, with much mill refuse mixed with it, was deposited on the foot of Island 49 and on and to the left of the bar. There were removed 117,100 cubic yards of sand.

At Island 36 (mile 87).—The bar between Island 36 and the mouth of Beef Slough threatened to become troublesome. Dredge *Geyser* was moved to this point and worked from August 1 to 20, cutting a temporary channel through the bar. The bar contained much bark and mill refuse. The material dredged, 19,000 cubic yards of sand, was deposited on and below Island 36.

The dredging at islands 36 and 49 cost $8,904.64, including $283.89 for general superintendence and $745.12 for plant charge. The actual working time of the dredge was 1,355 hours. A total of 136,100 cubic yards of sand were dredged, at a cost of $0.0654 per cubic yard. The length of discharge pipe varied from 350 to 500 feet.

BUILDING DAMS AND SHORE PROTECTIONS.

The building of dams and shore protections was resumed under project approved May 21, 1904, and an allotment of $50,000 from the appropriation of April 28, 1904, the work being carried on by hired labor and use of Government plant, towboats *Fury* and *Ada* doing the towing. Materials were purchased under emergency contracts at the following prices per cubic yard, delivered on United States barges: Riprap rock, 68, 68.5, 69.5, 72.5, and 74 cents; fascines, 16.6, 16.7, and 17.8 cents.

Operations were begun in the vicinity of Minneiska July 1. The channel above Island 50 had become crooked and narrow, causing trouble for raft navigation. The only practicable remedy was to make a new channel on the opposite side of the bar, near Island 49. The provisional project for this stretch (miles 97–100) was modified and the channel limits reduced to 700 feet. To assist in forming the new channel at Island 49 dredging was carried on in connection with dam building. To accomplish the change of channel the following dams were built from the left bank opposite Island 49: Wing Dams 44, 46, 47, 58, and 59, and Ell Dam 45 (sheet 16[a]). In order to deepen the water on the crossing above Minneiska and to hold the channel in proper position dams were built as follows: From the right bank, below the Zumbro River, Wing Dams 47 and 48 (sheet 15) and Wing Dam 61 (sheet 16); above Minneiska, Wing Dams 50, 51, 55, and 56; below Minneiska, Wing Dams 48 and 49; from the left bank, opposite Minneiska, Closing Dam 57 and Wing Dams 52, 53, and 54, and Wing Dam 60 was begun. The left bank above Minneiska was protected for a length of 5,100 feet and width of 40 feet, and opposite the head of Island 49 for a length of 920 feet and width of 45 feet; 110 feet of the latter crosses a dry slough at the upper end and is 20 feet wide. The dams are built to a height of 4 feet above low water of 1864. Owing to the rise of water during October some of the dams were not trimmed to grade. The shore protections are carried to the top of the banks, 5 to 8 feet above low water, the banks being low in this vicinity.

Emergency Wing Dam 59 (sheet 14, mile 87), above the mouth of Beef Slough, was raised to 3 feet above low water.

Wing Dam 12 (sheet 7, mile 29) was built from the right bank at the Point Douglas ferry landing. This dam is 200 feet long and 4.5 feet above low water. This

[a] Sheet numbers are those of general maps, survey 1878–79.

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length includes 130 feet built in former years by the ferryman as a landing during low stages.

Operations for the season were discontinued October 22 and the fleet moved to Fountain City to go into winter quarters in the bay.

Further details are given in the following list of works and financial statements:

List of works constructed and repaired and of materials used during the season of 1904 between St. Paul and Winona.

Designation.	Length.	Height above low water, 1864.	Rock.	Fascines.
	Feet.	*Feet.*	*Cub. yards.*	*Cub. yards.*
Sheet 7 (mile 29): Wing Dam 12	200	4.5	148.4	320.9
Sheet 14 (mile 87): Emergency Wing Dam 59, raised	.....	3.0	158.7	.....
Sheet 15 (miles 97–98):				
Wing Dam 47	195	4.0	583.9	1,655.3
Wing Dam 48	260	4.0	609.4	2,547.0
Shore protection, left bank above Minneiska	500	5 to 8	750.0	800.0
Sheet 16 (miles 98–100):				
Shore protection, left bank above Minneiska	4,600	5 to 8	6,788.9	7,246.1
Wing Dam 44	150	4.0	159.9	172.1
Ell Dam 45	1,220	4.0	1,245.5	2,480.4
Wing Dam 46	625	4.0	1,141.2	2,638.4
Wing Dam 47	640	4.0	1,546.7	4,909.6
Wing Dam 48	245	4.0	461.4	1,557.9
Wing Dam 49	425	4.0	723.4	2,095.6
Wing Dam 50	520	4.0	922.4	3,285.7
Wing Dam 51	570	4.0	1,309.8	3,866.3
Wing Dam 52	80	4.0	259.6	541.1
Wing Dam 53	150	4.0	345.7	1,095.5
Wing Dam 54	260	4.0	377.9	778.4
Wing Dam 55	250	4.0	630.6	1,904.7
Wing Dam 56	480	4.0	825.8	2,797.7
Closing Dam 57	75	4.0	249.9	380.1
Wing Dam 58	750	4.0	1,871.9	6,055.0
Wing Dam 59	700	4.0	2,266.9	3,962.5
Wing Dam 60, not completed	120	2.5	158.5	451.3
Wing Dam 61	285	4.0	609.5	2,349.9
Shore protection opposite Minneiska	920	5 to 7	1,388.6	1,468.3
Total	.....	.....	25,434.5	55,344.8

Financial statement for work of building dams and shore protections between St. Paul and Winona for the calendar year 1904.

Amount expended in the field		$45,365.61
Add for general superintendence and office expenses		1,619.55
Add for use and deterioration of plant		3,878.99
Total		50,864.15
Material put in place:		
Rock	cubic yards	25,434.5
Fascines	do	55,344.8
Total	do	80,779.3
Average cost per cubic yard:		
On barges		$0.332
For towing		.081
For putting in		.126
For local superintendence while not in field		.022
For general superintendence and office expenses		.020
For plant		.048
Average cost per cubic yard, in place		.629

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IN GENERAL.

The construction of 11 barges at St. Paul, under emergency contract with George Hagen, dated July 31, 1903, was completed February 25, 1904. All materials were furnished by the Government. The lumber used was Washington fir. During May, 5 of the barges were delivered by U. S. towboat *Fury* at Fountain City, Wis., and 6 at Portage, Mo.

Thirty-seven buoys were placed during June to mark the ends of dams near the channel.

Surveys were made during the season at Harriet Island (miles 1–2); below Broadway, St. Paul (mile 3); at Dayton's Bluff (mile 4); below Nininger (miles 24–25); Island 36 (mile 87); at Alma (miles 85–89); at Minneiska (miles 97–101); at Fountain City (miles 106–109). The gauge at Red Wing (mile 50), having been disturbed by work in progress for making a new levee, was reset temporarily.

During the coming season work in the vicinity of Minneiska and above Fountain City should be completed. Work in the vicinity of Beef Slough will probably be necessary. A closing dam should be built back of Island 47. Shore protections should be built below Alma and above the mouth of Zumbro River. The shore protection of Argo Bend should be repaired, and the dams opposite should be repaired and extended.

Very respectfully, your obedient servant,

J. D. DUSHANE,
Assistant Engineer.

Maj. JAS. L. LUSK,
Corps of Engineers.

REPORT OF MR. W. A. THOMPSON, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
La Crosse, Wis., January 21, 1905.

MAJOR: I have the honor to submit the following report of operations for improving the Mississippi River in the division in my local charge for the calendar year ending December 31, 1904:

WINONA TO WISCONSIN RIVER.

The improvement of this portion of the river, by the construction of rock and fascine dams and shore protections, was carried on by hired labor and use of Government plant, towboats *Alert* and *Elsie* doing the towing. The rock used was lime rock, quarried and loaded on United States barges by hired labor and use of Government plant. The fascines were purchased in open market, under emergency contracts, at 15.9, 16, 16½, 16.9, and 19 cents per cubic yard on United States barges.

Necessary repairs having been made, the greater part of the fleet was placed in commission June 17, the remainder being placed in commission July 5, 1904. Regular construction work was commenced June 17, 1904.

The Government quarry at Lamoille, Minn., was operated by a single crew on an eight-hour basis, whereas, for economical working, were funds sufficient, it should run at least sixteen hours a day.

Between June 17 and October 21, improvements and repairs were made in the vicinity of Lamoille, Dresbach, and Cottage islands, below La Crosse, below Genoa, and in the vicinity of Bad Axe Bend.

Vicinity of Lamoille.—Shore protection opposite Island 78 (mile 125), on which work was suspended during the high water of 1903, was completed.

Vicinity of Dresbach and Cottage islands.—The projects of 1902 and 1903, for the permanent improvement of this part of the river, were completed and extended.

During the season, in mile 136, Wing Dam 41, from the Wisconsin shore, 500 feet below Island 94, was completed; entire length, 630 feet. Wing Dams 49 and 51, from the Minnesota shore, and Wing Dam 50, from near the foot of Island 94, were repaired.

In mile 137, Wing Dam 72, a wing extending from the upper end of Trailer Dam 57, from the head of Dresbach Island, and Wing Dam 73, from the Wisconsin shore, were built; total length, 1,040 feet. Wing Dam 39, from the Wisconsin shore, and Wing Dam 53, which on account of its exposed position to ice needed heavy rocking, were repaired.

In mile 138, Wing Dams 56 and 70, from the Wisconsin shore, opposite the middle of Dresbach Island, commenced in 1903. were completed; total length, 635 feet.

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These dams were built in exceptionally deep and swift water, and mats were sunk in place with great difficulty. Shore protection on Wisconsin shore, opposite head of Dresbach Island, commenced in 1902 and continued in 1903, was completed, together with shore protection on channel side of Dresbach Island, commenced in 1903; total length, 4,150 feet. Wing Dam 55, from the Wisconsin shore, was raised and repaired, particularly at the end where the current had undermined it.

In mile 139, Wing Dam 74, from the foot of Dresbach Island, and Wing Dam 75, from the Wisconsin shore opposite the foot of Island 97, were built; total length, 490 feet. Shore protection opposite foot of Dresbach Island, commenced in 1903, was completed; length, 1,500 feet. Wing Dams 36 and 40, from the Wisconsin shore, and Wing Dam 65, from the foot of Dresbach Island, were repaired.

In mile 140, shore protection on Cottage Island was built; length, 730 feet. This revetment protects the head of the island, which was cutting away. Wing Dams 38 and 39, from the Wisconsin shore, were partly repaired. These dams are to be raised and extended to the proposed channel line.

In mile 141, the extension of shore protection on Island 98 was commenced, 1,610 feet of mat was laid, and the bank partially rocked; not completed. This shore protection extends from inside the island, joining shore protection of Closing Dam 17, around the head and down the channel side, where the bank was cutting fast. Closing Dam 17 was repaired and raised, but not completed, as the high stage of water caused such a current over the dam as to render building operations at that stage very expensive.

Below La Crosse.—Shore protection on Island 112 was repaired. These repairs were slight, but were necessary to protect the roadway from La Crosse over the high Closing Dam 46 and down the island.

Below Genoa.—In mile 164 Closing Dam 21 was built back of Island 126, 900 feet below Closing Dam 1; length, 410 feet. Shore protection on Island 126, on the inside of the island from the dam to the present head of the island, was built; length, 300 feet. It was thought better, both on account of first cost of construction and permanence of work, to put in this dam and shore protection in preference to repairing the large break in the shore protection and bank near the head of Island 126.

Vicinity of Bad Axe Bend.—In mile 167 Closing Dam 20 was built across a small break on the inside of the island; length, 140 feet. Closing Dam 11, built in 1893 across the head of Lost Channel, was raised. In mile 168 Closing Dam 10, built in 1893, was raised.

Operations were suspended October 21, and the fleet placed in winter quarters in Fountain City Bay and Black River, at La Crosse, Wis.

Further details as to length and height of each dam and shore protection and amounts of materials used are given in the following table:

List of works constructed and repaired, and of materials used, during the season of 1904, Winona to Wisconsin River.

Designation.	Length.	Height above low water, 1864.	Rock.	Fascines.
	Feet.	*Feet.*	*Cub. yds.*	*Cub. yds.*
Sheet 19 (mile 125): Shore protection opposite Island 78, begun in 1903, extended	240	6.0	776.3	2,038.1
Sheet 20 (miles 136–139):				
Wing Dam 41, extended and completed	430	4.0	977.5	2,629.9
Wing Dam 50, repaired	.....	4.0	101.6	.....
Wing Dam 51, repaired	.....	4.0	581.1	1,378.6
Wing Dam 49, repaired	.....	4.0	687.9	2,463.5
Wing Dam 72	380	4.0	695.8	1,426.8
Wing Dam 73	710	4.0	997.4	3,426.8
Wing Dam 39, repaired	.....	4.0	905.6	2,170.7
Wing Dam 53, repaired	.....	4.0	94.9	593.9
Wing Dam 56, extended and completed	160	4.0	2,171.6	4,270.2
Wing Dam 70, extended and completed	225	4.0	2,585.4	5,668.9
Shore protection opposite Dresbach Island, completed	.....	11.0	1,388.5	452.7
Wing Dam 55, repaired	.....	4.0	668.2	1,058.0
Shore protection Dresbach Island, completed	.....	10.0	682.8	.....
Shore protection opposite foot of Dresbach Island, completed	.....	11.0	186.8	.....
Wing Dam 65, repaired	.....	4.0	185.9	883.5
Wing Dam 74	300	4.0	1,178.6	3,256.5
Wing Dam 75	190	4.0	536.1	1,261.1

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List of works constructed and repaired, and of materials used, during the season of 1904, Winona to Wisconsin River—Continued.

Designation.	Length.	Height above low water, 1864.	Rock.	Fascines.
Sheet 21 (miles 139–141):	*Feet.*	*Feet.*	*Cub. yds.*	*Cub. yds.*
Wing Dam 40, repaired		4.0	633.8	2,530.4
Wing Dam 36, repaired		4.0	1,067.3	3,527.8
Shore protection, Cottage Island	730	7.5	849.8	1,126.5
Wing Dam 38, repaired (unfinished)		4.0	941.1	3,472.1
Wing Dam 39, repaired (unfinished)		4.0	750.9	2,177.5
Shore protection Island 98, extended (unfinished)	1,610	10.0	1,795.2	3,126.0
Closing Dam 17, repaired (unfinished)		4.0	1,376.6	3,956.6
Seeet 22 (mile 148): Shore protection Island 112, repaired		8.0	398.8	268.9
Sheet 24 (miles 164–168):				
Closing Dam 21	410	4.0	1,590.1	5,705.8
Shore protection inside Island 126	300	7.0	495.4	754.2
Closing Dam 11, repaired		4.0	890.2	1,599.1
Closing Dam 20	140	4.0	99.6	823.9
Closing Dam 10, repaired		4.0	999.4	2,994.6
Total			27,260.2	64,992.6

Financial statement for work between Winona and Wisconsin River, performed by hired labor, during season of 1904.

Amount expended in field during calendar year 1904 (from distribution sheets)		$51,763.76
Add quota of general superintendence and office expenses		1,847.97
Add for use and deterioration of plant, quarry	$2,397.05	
Add for use and deterioration of plant, building dams, etc	5,020.11	
		7,417.16
Total		61,028.89
Materials put in works:		
Rock	cubic yards	27,260.2
Fascines	do	64,992.6
Total	do	92,252.8
Average cost per cubic yard:		
On barges		$0.322
For towing		.102
For putting in place		.147
For general superintendence and office expenses		.020
For local office expenses		.017
For plant		.054
Average cost per cubic yard in place		.662

Quarrying rock at Lamoille, Minn. (mile 125).—Work was performed by hired labor and use of Government plant, the cable hoist being employed in transporting rock from the quarry on the top of the bluff, 500 feet above water surface, to barges. Rand and Ingersoll-Sargent steam drills were used for drilling. Operations were commenced June 14, with a single crew, working eight hours per day, and continued until October 20, 1904, the close of the season.

Financial statement for work of quarrying rock at Lamoille, Minn., performed by hired labor, during season of 1904.

Amount expended during calendar year 1904 (from distribution sheets)	$14,807.65
Add quota of general superintendence and office expenses	528.63
Add for use and deterioration of plant	2,397.05
Total	17,733.33

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Total cubic yards rock quarried and loaded on United States barges during season 1904	$27,260.2
Average cost per cubic yard:	
On barges	$0.543
For general superintendence and office expenses	.019
For plant	.088
Average cost per cubic yard on barges	.650

SURVEYS.

In July a series of soundings were made in Bad Axe Bend and vicinity (miles 167–168) and in the vicinity of Island 126 (mile 164).

August 20–23 a sounding survey was made from Dakota to River Junction (miles 135–142). Notes were plotted and proposed channel lines drawn in.

November 16–26 detached surveys were made between Winona and Brownsville. Sounding lines were located by measurement from established points, dams, etc., and as a rule were 300 feet apart, sounding being taken every 15 seconds. Changes in topography since the last survey were indicated, and the condition of bank and dams noted. These surveys covered the following territory: From the upper bridge at Winona (mile 116) to a point one-half mile below the lower bridge (mile 119); from the foot of Blacksmith Island (mile 123) to Lamoille (mile 126); from Island 84 (mile 129) to Queens Bluff (mile 132); from a little above Dakota (mile 135) to the foot of Broken Arrow Island (mile 147); and from Island 115 (mile 152) to a point 1 mile below Brownsville (mile 155). Number of miles surveyed, 24. The notes are being plotted.

PLANT REPAIRS AT FOUNTAIN CITY.

Plant repairs were carried on at Fountain City boat yard by hired labor and use of Government plant from January 1 to November 21, 1904. During this period repairs to plant belonging to the division St. Paul to Winona were made in addition to the repairs made to the plant used in this division. During the season repairs were made to U. S. towboats *Alert*, *Fury*, and *Elsie*, launch *Myra*, 4 quarter boats, 1 building boat, 2 grasshoppers, 14 barges, 1 coal flat, and 1 ponton. The construction of a new hull for towboat *Ada* was completed, and 1 new building boat, 3 barges, and a store boat were built.

Mr. J. F. McDonough, clerk, and Mr. H. T. Eastman, inspector, deserve credit for the able and efficient manner in which they have assisted me in this work.

Very respectfully, your obedient servant,

W. A. THOMPSON,
Assistant Engineer.

Maj. JAS. L. LUSK,
Corps of Engineers.

REPORT OF MR. S. EDWARDS, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Rock Island, Ill., January 13, 1905.

MAJOR: I have the honor to submit the following report of operations for improving the Mississippi River between the Wisconsin River and Bellevue, the division in my local charge, for the calendar year ending December 31, 1904:

BUILDING DAMS AND SHORE PROTECTIONS.

Construction work was carried on by hired labor and use of Government plant, towboat *Vixen* and launch *Louise* doing the towing. Material was purchased in open market in accordance with existing regulations, and was furnished on United States barges at the following prices: Rock, 55, 59, 59½, 61½, 62, and 65 cents per cubic yard; fascines, 16½, 16¾, 17, 17¾, 17.9, 18, and 20 cents per cubic yard. Operations were begun July 5 and closed for the season Novembr 9, when the fleet was laid up in Dubuque Ice Harbor.

Work consisted of building 6,860 linear feet of dams and 5,615 linear feet of shore protection and in repairing two closing dams.

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Further details are given in the following table and financial statement:

List of works constructed and repaired, and of materials used during the season of 1904, Wisconsin River to Bellevue.

Designation.	Length.	Height above low water, 1864.	Rock.	Fascines.
Sheet 34 (miles 245-247):	*Feet.*	*Feet.*	*Cubic yds.*	*Cubic yds.*
Closing Dam 2, repaired	.....	5	2,347.0	3,209.2
Wing Dam 3, repaired	.....	4	2,020.1	2,732.0
Wing Dam 6	510	4	874.1	1,610.9
Wing Dam 7	470	4	926.4	1,922.1
Wing Dam 8	520	4	729.8	1,424.3
Wing Dam 9	520	4	770.6	1,467.9
Wing Dam 10	250	4	477.1	612.9
Shore protection Hurricane Island (upper), extended.	1,100	10	1,365.6	2,073.5
Shore protection Hurricane Island (lower), extended.	1,285	10	1,922.5	2,532.8
Shore protection Hurricane Island (lower), repaired.	70	.....	99.4	65.8
Sheet 35 (miles 252-256):				
Closing Dam 1, repaired	.....	5	672.9	822.8
Wing Dam 6, repaired	.....	4	1,302.1	950.9
Closing Dam 17	600	4	2,788.9	3,329.8
Wing Dam 18	1,350	4	2,296.3	4,388.6
Wing Dam 19	750	4	1,480.8	3,147.6
Closing Dam 20	1,490	2	5,251.6	10,564.3
Shore protection head Island 214	980	12	1,346.6	1,609.4
Shore protection Iowa shore below Parsons bar	2,300	11	2,770.0	4,580.1
Sheet 36 (mile 256): Closing Dam 7	400	4	2,238.7	3,879.5
Total	.....	.....	31,630.5	50,874.4

Financial statement for work of building dams and shore protections between Wisconsin River and Bellevue in 1904.

Amount expended in field during calendar year	$52,464.99
General superintendence and office	1,875.05
Plant charge	4,829.33
	59,169.37
Material put in works:	
Rock ..... cubic yards	31,630.5
Fascines ..... do	50,874.4
Total ..... do	82,504.9
Average cost per cubic yard:	
On barges	$0.351
For towing	.094
For putting in place	.163
For local superintendence and office expenses	.029
For general superintendence and office expenses	.022
For plant	.058
Total	.717

DUBUQUE ICE HARBOR.

The driving of mooring piles in Dubuque Harbor, begun in November, 1903, and discontinued a few days later on account of ice, was resumed April 7, 1904, and completed April 14. Forty-three piles were driven, in clusters of three, one row on the north and one on the south side, making a total of 73, at a cost of $857. They have proven a great help to Government fleet and private craft wintering in the harbor.

December 7 and 8 a survey was made of the harbor to determine how much the harbor had filled up by sediment since the dredging in 1898. The map and estimates for dredging have been submitted to you.

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REPAIRS TO PLANT.

Repairs to fleet in Dubuque Harbor were commenced February 10 and completed June 28, 1904. Extensive repairs were made to office boat *No. 69*, quarter boat *No. 11*, barges *Nos. 4, 7, 143, 144, 170, 171, 176, 177*, and *186*, and slight repairs to towboat *Vixen*, launch *Louise*, quarter boat *No. 118*, grasshopper *No. 112*, coal barge *No. 53*, and barges *Nos. 98, 99, 145, 153, 161, 162*, and *174*.

SURVEY VICINITY OF GUTTENBERG AND GLENHAVEN.

The survey ordered by the Board of Engineers appointed to investigate the river in the above-named vicinity was begun August 9 and completed September 7. The survey covers miles 223 to 237, including Guttenberg channel, Cassville Slough, and Ferry Slough, and was made in the usual manner. The map was plotted in the field and forwarded to your office.

An examination in the vicinity of Clayton was also made.

The total number of miles surveyed was 26, at a cost of $1,395.25, or $50.20 per mile.

I was ably assisted by Mr. H. R. Howes, surveyor, on the above work.

IN GENERAL.

The stage was favorable throughout the season for navigation, and even at the low stage of 3.3 feet little inconvenience was experienced, except at Hurricane Island (mile 245) and Parsons bar (mile 254). Both of these places should be in fair condition by next season.

I was ably assisted by Mr. E. F. Linderman, overseer, on whom much of the field work devolved during my absence on other duties. Mr. Jos. B. Drechsler, timekeeper, also deserves much credit for faithful work.

Very respectfully, your obedient servant,

S. EDWARDS,
Assistant Engineer.

Maj. JAS. L. LUSK,
Corps of Engineers.

REPORT OF MR. J. C. M'ELHERNE, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Rock Island, Ill., February 4, 1905.

MAJOR: I have the honor to submit the following report of operations for improvement of the Mississippi River in the division in my local charge for the calendar year ending December 31, 1904:

BELLEVUE TO LECLAIRE.

Work in this section was carried on under two contracts.

Contract of 1903.—Under project approved August 4, 1903, and allotment of $35,000, a contract, dated July 6, 1903, was entered into with Fetter & Crosby for the construction of dams and shore protections of rock and fascines, at 56 cents per cubic yard for fascines and $1.39 per cubic yard for rock in place.

Work was begun on May 13, 1904, and the contract was finished on August 4, 1904. Operations were confined to the section of river between the foot of Elk River Slough and Island 286. Through this reach, which for the greater part was very wide, shoal, and flat, a crooked changing channel, with two or more troublesome crossings, ran for many years past, and during medium and low stages gave great annoyance to navigators.

Vicinity of Island 282 (miles 318–319).—Opposite foot of this island the head and shoulder of a high willow bar was revetted 430 feet, but not finished, and old Closing Dam 11, begun in 1896, was raised to 4 feet above low water for a distance of 1,140 feet, and its shore protections were repaired.

Vicinity of Island 283 (miles 320–321).—Old closing dams 13 and 14 were raised to 4 feet above low water for a distance of 700 and 500 feet, respectively (the latter dam having been extended upstream 135 feet), and repairs were made to their shore protections. Closing dams 16 and 15 were built, the former between the first and second small islands below Island 283, and the latter one between the fourth small island below Island 283 and the left bank. Just below this point were built wing dams 19 and 20 from same shore.

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Vicinity of Island 285 (miles 321–322).—Closing Dam 17 was built between this island and Island 286, and Closing Dam 18 between it and the right bank. From Island 286 wing dams 21 and 22 were built, but the latter dam was not completed.

Revetment was commenced on shoulder of small island opposite Island 285, but was not finished.

Mr. R. Monroe, junior engineer, acted as inspector on the work, and deserves much credit for intelligent and faithful performance of service.

List of works constructed and repaired and of materials used during the season of 1904, under contract with Fetter & Crosby, between Bellevue and Leclaire.

Designation.	Length.	Height above low water, 1864.	Rock.	Fascines.
Sheet 43 (miles 318–322):	*Feet.*	*Feet.*	*Cub. yds.*	*Cub. yds.*
Closing Dam 11, raised	.....	4	1,510.6	1,962.5
Closing Dam 13, repaired	.....	4	663.1	240.6
Closing Dam 14, repaired	.....	4	577.4	275.3
Closing Dam 15	640	4	2,088.9	4,107.6
Closing Dam 16	450	4	1,968.2	4,320.4
Closing Dam 17	500	4 and 10	795.5	884.0
Closing Dam 18	450	4	1,333.9	2,306.1
Wing Dam 19	895	4 and 6	1,220.2	2,780.5
Wing Dam 20	370	4	732.4	1,725.6
Wing Dam 21	425	4	965.8	2,517.7
Wing Dam 22 (unfinished)	450	1	872.0	1,969.5
Shore protection on head of willow bar, opposite foot of Island 282	490	8	580.9	544.9
Shore protection on head of fourth island, below Island 283	450	8	689.7	465.5
Total	.....	.....	13,933.6	24,240.2

Financial statement for work between Bellevue and Leclaire, performed under contract with Fetter & Crosby during season of 1904.

Amount paid contractor	$32,942.23
Add cost of local inspection	1,125.12
Add quota of general superintendence and office expenses	1,216.70
Add plant charges	50.53
Total	35,334.58

Material put in works:

Rock	cubic yards	13,933.6
Fascines	do	24,240.2
Total	do	38,173.8

Average cost per cubic yard in place	$0.926
Average cost per cubic yard for inspection	.029

Contract of 1904.—Under project approved May 21, 1904, and allotment of $35,000, a contract, dated August 15, 1904, was entered into with A. B. Teasdale for the construction and repair of dams and shore protections of rock and fascines, at 35 cents per cubic yard for fascines and $1.24 per cubic yard for rock in place.

Work was commenced on September 12, 1904, and closed for the season on November 5, 1904, but lack of a suitable fleet, scarcity of outfit and barges, and high water toward the close, greatly delayed progress and was the cause of the poor showing made. Operations carried on were for the further betterment of the crooked channel through the wide, shoal, and flat stretch of river between the foot of Elk Slough and Island 286.

Vicinity of Island 282 (miles 318–319).—From shoulder of high willow bar opposite foot of this island revetment was carried downstream and finished.

Vicinity of Island 283 (mile 320).—Revetment was commenced at the head of second island below Island 283, but was not completed.

Mr. R. Monroe, junior engineer, served as inspector, and performed his duties very satisfactorily.

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List of works constructed and repaired and of materials used during the season of 1904, under contract with A. B. Teasdale, between Bellevue and Leclaire.

Designation.	Length.	Height above low water, 1864.	Rock.	Fascines.
Sheet 43 (miles 318-321):	*Feet.*	*Feet.*	*Cub. yds.*	*Cub. yds.*
Shore protection on willow bar opposite foot of Island 282 extended	525	8	667	923.8
Shore protection on second island below Island 283	90	9	128	218.3
Total			795	1,147.1

Financial statement for work between Bellevue and Leclaire, performed under contract with A. B. Teasdale during season of 1904.

Amount paid contractor		$1,248.56
Add retained percentage on contract		138.73
Add cost of local inspection		840.98
Add quota of general superintendence and office expenses		79.55
Add plant charges		8.75
Total		2,316.57
Material put in works:		
Rock	cubic yards	795.0
Fascines	do	1,147.1
Total		1,942.1
Average cost per cubic yard in place		$1.193
Average cost per cubic yard for inspection		.433

IMPROVING ROCK ISLAND RAPIDS.

The section of river comprising the Rock Island Rapids extends from mile 348 to mile 364 below St. Paul.

The portion of the fleet required for early active service was put in desirable condition first and the remainder as soon afterwards as practicable. The work of drilling, blasting, dredging, etc., was begun by drill boat *No. 103* on April 21, 1904, followed soon afterwards by dredge *Ajax*, and much later on by drill boat *No. 6* and derrick barge *No. 220*.

Dams.—Wing Dam 3 (sheet 47), abreast of Campbells chain, was raised, widened, and repaired from the shore end out for a distance of 600 feet; width on top, 12 feet, and height 3½ feet above low water. Wing Dam 6½, abreast of Campbells chain, was repaired, widened, and raised its entire length, 700 feet, to a width of 8 feet and a height of 3½ feet above low water. Rock used for the purpose was the spoil obtained by dredge *Ajax* from channel at various points on the rapids.

Guide piers.—Some of the guide piers, having been injured by the action of ice gorges and floods, had their foundations repaired and strengthened. Nos. 3, 6, 7, 12, and 24 received necessary attention, and their upper ends and sides were reenforced with riprap rock furnished by dredging.

Rock excavation.—One steam-drill boat only was employed in regular blasting operations. Drill boat *No. 103*, with double crew, resuming where work was stopped in the fall of 1903, continued operations from April 21 to June 16, 1904, on the long and high left shoulder of lower chain; from June 17 to October 14 it disrupted the high rock patches (three of them quite large) in the right side of Smiths chain, with the exception of 6 days spent in reblasting at lower chain. Between October 14 and November 9 the drill boat blasted the small projecting shoulder of Sycamore chain, the high shoulder at left side of Cottonwood chain, and the rough rock shoulder at the foot of Moline chain. The areas worked over were 33,000, 49,694, 3,431, 900, and 3,000 square feet, respectively, and the depth of drilling ranged from 3.1 to 6.5 feet. Very hard rock, covered deeply in places with gravel and sand and occasionally containing pockets of fire clay, was encountered in most of the localities mentioned.

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Considerable reblasting was done, and many high solid rock points were found by sweeping over the river bottom and handled in the usual way.

The drill boat was laid up for the winter on November 9, 1904.

Drill boat *No. 6*, with single crew (used partly for blasting purposes), was fitted up with steel drag rails, blocks, grapplings, etc., and from July 27 to 31, 1904, swept over the channel bottom in the lower section of Smiths chain and from August 1 to November 9—the date of closing for the season—dragged over the entire reach from Smiths chain down to foot of Sycamore chain, a distance of 5,600 feet, and a small portion of the left shoulder of the reef opposite Stubbs Eddy. Several small high solid rock patches and numerous isolated points, from 0.3 to 1.5 feet above grade, including a large bowlder in the latter locality, which had broken up a raft and severely injured its towboat, were discovered and blasted, together with a great many scattered loose rocks removed and saved for use, excepting small lots difficult to take out, which were raked into deep water.

Derrick barge *No. 220*, with single crew (used for sweeping, etc.), was likewise provided with drag rails, grapplings, etc., and from August 2 to September 19, 1904, operated on the left shoulder of Sycamore and lower chains, searching for and removing from the tops of reefs and edges of cuts the débris that could not be reached by the dredge. A considerable quantity of such rock, much of which was greatly scattered and of large size, was hoisted out and loaded on barges with derricks and by hand until the weather finally became too cold for further operations in the water.

Dredging rock.—Dredge *Ajax*, with single crew, from April 26 to June 4, 1904, worked at removing the débris resulting from blasting in former years from the right shoulder of Campbells chain. From June 5 to July 27 it removed blasted rock from the left shoulder of lower chain, and from July 28 to November 9 (except 20 days in September while employed on work outside of division) it removed broken rock from the right shoulder below Smiths chain, from disrupted patches in Smiths chain, and from a small projecting shoulder from the right edge of Sycamore chain.

All boats belonging to the fleet were run into Silver Lake Harbor immediately upon discontinuance of work for the season, and by November 12 were safely quartered there for the winter Those pieces needing extensive repairs were banked and blocked up, while the remainder, which required but little attention, was kept afloat.

Owing to the expense of thoroughly cleaning up the various odds and ends of light and much-scattered blasting, sweeping, and dredging under project of 1899 (now nearing completion) and of moving the different boats over extensive areas of unfinished river bottom, the cost of the work was greatly increased over that of former years.

Mr. J. B. Gordon, overseer, and Mr. John B. Corken, clerk, deserve much credit for efficient performance of their duties.

Details of operations, season of 1904.

Towboat *Ruth:*		
Hours in use under steam		793
Miles run, light		1,226
Miles run, towing		1,683
Miles run, total		2,909
Towboat *Mac:*		
Hours in use under steam		780
Miles run, light		910
Miles run, towing		1,213
Miles run, total		2,123
Launch *Emily:*		
Hours in use under steam		1,171
Miles run, light		2,055
Miles run, towing		1,798
Miles run, total		3,853
Drill boat *No. 103:*		
Hours worked		2,695
Hours lost owing to accidents, rafts, storms, etc		65
Holes drilled		3,228
Holes blasted		2,918
Linear feet of holes drilled		11,204.8
Ledge rock blasted	cubic yards	3,929.4
Pounds dynamite used		7,532
Range poles set in rock bottom		293
Ring bolts set		10
Water gauges set		7
Buoys reset		3

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Drill boat *No. 6* (sweeping, etc.):	
Hours worked	747
Hours lost owing to accidents, rafts, storms, etc	13
Holes drilled	426
Holes blasted	416
Linear feet of holes drilled	1,581.6
Ledge rock blasted.....cubic yards	415.1
Pounds dynamite used	1,308.5
Range poles set in rock bottom	3
Ring bolts set	6
Water gauges set	0
Buoys reset	1
Cubic yards loose rock and bowlders removed	265
Derrick barge *No. 220* (sweeping, etc.):	
Hours worked	314
Hours lost owing to accidents, rafts, storms, etc	18
Cubic yards loose rock and bowlders removed	275
Dredge *Ajax:*	
Hours worked	1,190
Hours lost owing to accidents, rafts, storms, etc	34
Cubic yards loose rock, fire clay, gravel, etc., dredged and removed	9,501

Cost of rock excavation, including charges for use and deterioration of plant.

Designation.	Ledge rock excavated.	Total cost.	Average cost per cubic yard.
Blasted and removed:	*Cubic yds.*		
Rock patches in Smith chain	1,610.0		
Shoulder of Sycamore chain	277.0		
Rock patches in Sycamore chain	415.1		
Rock patches in Cottonwood chain	45.0		
Rock patches in Moline chain	68.0		
Shoulder of lower chain	1,034.4		
Total	3,444.5	$27,383.78	$7.95
Dredged only:			
Rock patches in Smith's chain [a]	400.0		
Shoulder of Campbell's chain [b]	1,151.3		
Shoulder of lower chain [a]	23.0		
Total	1,574.3	2,751.46	1.748
Grand total	5,018.8	30,135.24	

NOTE.—The material covered by the items marked "*a*" in the above table was blasted in 1903 at a cost of $1,184.40, or $2.80 per cubic yard, which, added to cost of dredging in 1904, $739.28, gives $1,923.68, or $4.55 per cubic yard for total amount of material in those localities.

The material in item "*b*" was blasted in 1897, at a cost of $3,757.84, or $3.264 per cubic yard, which added to cost of dredging in 1904, $2,012.13, gives $5,769.97, or $5.01 per cubic yard for total amount of material in that place.

Cost of repairs to old piers, including charges for use and deterioration of plant.

Material.	Cubic yards.	Total cost.	Cost per cubic yard.
Riprap rock in place	889	$587.30	$0.70

List of dams repaired and amounts of material used for same during the season of 1904.

Designation.	Length.	Height above low water, 1864.	Rock.
Sheet No. 47:	*Feet.*	*Feet.*	*Cubic yds.*
Wing Dam 3, repaired	600	3.5	2,793
Wing Dam 6½, repaired	850	3.5	1,198
Wing Dam 15, repaired	700	3.5	773
Total			4,764

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Cost of dams, including charge for use and deterioration of plant.

Cubic yards riprap rock in place	4,764
Total cost of riprap rock in place	$3,334.80
Cost per cubic yard for towing	$0.2089
Cost per cubic yard for putting in place	$0.4911
Total cost per cubic yard	$0.70

Financial statement for improvement of Rock Island Rapids for season of 1904.

Amount expended in field	$29,536.36
Add quota of general superintendence and office expenses	1,054.95
Add for use and deterioration of plant	4,757.11
Total	35,348.42
Distributed as follows:	
Rock excavated and removed	27,383.78
Rock broken up in 1897 and 1903, but dredged in 1904	2,751.46
Rock unavoidably raked into deep water	1,291.08
Dams 3, 6½, and 15, repairs to	3,334.80
Guide piers 3, 6, 7, 12, and 25, repairs to	587.30
Total	35,348.42

SURVEYS.

Between May 16 and August 5, 1904, two surveys were made of the stretch of river in the vicinity of Pomme de Terre Prairie—one for each of the two contracts covering work of improvement in that locality, and on August 20 a survey of river at Fulton, Ill., was made, to ascertain the condition of the troublesome bar immediately in front of that town.

BUOYS ON ROCK ISLAND RAPIDS.

The buoys in stock were thoroughly overhauled and repaired, and 10 new buoys were provided for emergencies. Between May 3 and July 16 the buoys of the system were reset by towboat *Ruth* as needed; the ranges were then adjusted and all view-obstructing brush cleared away. Buoys torn from their fastenings by boats or rafts during the season were immediately replaced.

At the close of the season the ranges were again gone over, and on November 7, 1904, the buoys were taken up and laid away for the winter with the fleet pertaining to this work.

Total number of buoys in the system, 42; cost of buoyage for the season, $500.

Very respectfully, your obedient servant,

J. C. McELHERNE,
Assistant Engineer.

Maj. JAS. L. LUSK,
Corps of Engineers.

REPORT OF MR. C. W. DURHAM, PRINCIPAL ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Rock Island, Ill., January 30, 1905.

MAJOR: I have the honor to submit the following report of operations for improvement of the Mississippi River between Rock Island (mile 363) and Burlington (mile 442), the division in my local charge, for the calendar year ending December 31, 1904.

ROCK ISLAND TO BURLINGTON.

1. Under project approved April 6, 1903, and allotment of $35,000 from appropriation of March 13, 1903, contractors Fetter & Crosby on April 13, 1904, resumed operations (which had been suspended November 21, 1903) on their contract expir-

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ing August 5, 1904, and completed the contract May 11. The prices paid under this contract were $1.46 per cubic yard for rock and 58 cents per cubic yard for fascines, in place.

The work done in 1904 was the construction of three wing dams and one trailing dam opposite and a little below Montpelier (miles 378–379). These dams, although built to the required crest grade of 4 feet above low water, could not be properly trimmed and leveled on account of the high stage of water prevailing during the remainder of the life of the contract, and such work was postponed and afterwards performed under a subsequent contract.

List of works constructed and of materials used during the season of 1904 under the 1903 contract with Fetter & Crosby between Rock Island and Burlington.

Designation.	Length.	Height above low water, 1864.	Rock.	Fascines.
Sheet 50 (miles 378-379):	*Feet.*	*Feet.*	*Cub. yds.*	*Cub. yds.*
Wing dam 12	200	4	495.1	1,441.2
Wing dam 13	250	4	661.5	2,007.3
Wing dam 14	600	4	479.0	1,385.3
Trailing dam 15	800	4	783.5	2,509.6
Total			2,419.1	7,343.4

Financial statement for work performed (entire 1903 contract) between Rock Island and Burlington, under contract with Fetter & Crosby.

Amount paid contractor	$32,179.13
Cost of local inspection, etc	1,548.94
Quota of general superintendence and office expenses	1,244.35
For use and deterioration of plant	33.16
Total	35,005.58
Material put in works:	
Rock ..... cubic yards..	12,660.4
Fascines ..... do....	23,612.0
Total ..... do....	36,272.4
Average cost per cubic yard in place	$0.965
Average cost per cubic yard for inspection	.043

2. Under project approved May 21, 1904, and allotment of $35,000 from appropriation of April 28, 1904, contractors Fetter & Crosby commenced operations August 8, 1904, on their contract expiring August 29, 1905. Work was carried on until November 18, on which date the contractors' plant departed for Quincy Bay to go into winter quarters. The prices paid under this contract were $1.42 per cubic yard for rock and 52 cents per cubic yard for fascines, in place.

The work done during 1904 consisted in trimming and repairing Dams 11, 12, 13, and 14, wings from Smiths Island (mile 370); in raising and repairing Dams 17 and 23, wings from Horse Island (mile 368); in trimming Dams 11, 12, 13, and 14, wings from Andalusia Island, and Trailing Dam 15 (miles 377–378); in extending the shore protection above head of Hershey Chute 1,070 feet (mile 385); in repairing shore protection at head of Island 330 (mile 384); in repairing 3,250 linear feet of shore protection on right bank of Hershey Chute and extending the same at the foot of the chute 200 feet (mile 387); in repairing the shore protection at Dam 13 (mile 387); in constructing 4,150 linear feet of shore protection on right bank above Port Louisa (miles 402–403), and Dam 10 (mile 417), a wing from Blackhawk Island above Keithsburg Bridge, and in closing Blackhawk Chute.

The width of all shore-protection mat was 25 feet.

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List of works constructed and of materials used during the season of 1904 under the 1904 contract with Fetter & Crosby, between Rock Island and Burlington.

Designated.	Length.	Height above low water, 1864.	Rock.	Fascines.
	Feet.	*Feet.*	*Cub. yds.*	*Cub. yds.*
Sheet 48 (mile 368):				
Wing Dam 17, raised		4 to 8	154.5	174.5
Wing Dam 23, repaired		4	136.3	
Sheet 49 (mile 370): Wing Dams 11, 12, 13, and 14, trimmed		4	246.7	
Sheet 50 (miles 377–378): Dams 11, 12, 13, 14 and 15, trimmed		4	215.1	230.0
Sheet 51 (miles 384–387):				
Shore protection, head Island 330, repaired		10	147.8	164.8
Shore protection, head Hershey Chute, extended	1,070	10	989.0	1,059.1
Shore protection, right bank Hershey Chute, repaired		10	597.8	
Shore protection, foot of Hershey Chute, extended	200	10	199.7	200.0
Dam 13, repaired shore protection at end		4	98.4	
Sheet 53 (miles 402–403): Shore protection, right bank above Port Louisa	4,150	10	4,451.6	4,401.4
Sheet 54 (mile 416): Closing Dam 1, Blackhawk Chute, not completed	1,260	2 to 4	3,035.8	4,800.0
Sheet 55 (mile 417):				
Wing Dam 10	900	4	1,980.4	4,014.0
Total			12,203.1	15,043.8

Financial statement for work performed in 1904 between Rock Island and Burlington, under the 1904 contract with Fetter & Crosby.

Amount paid contractors	$22,636.06
Retained percentage on contract	2,515.12
Cost of local inspection	878.53
Quota of general superintendence and office expenses	929.76
Use and deterioration of plant	21.40
Total	26,980.87
Material put in works:	
Rock ..... cubic yards	12,203.1
Fascines ..... do	15,043.8
Total ..... do	27,246.9
Average cost per cubic yard in place	$0.990
Average cost per cubic yard for inspection	.032

HARBOR OF REFUGE AT AND BELOW DAVENPORT, IOWA.

Dredge *Vulcan*, with single crew, commenced dredging operations in Rockingham Slough June 8, and continued work until September 2, 1904, when she was relieved by dredge *Ajax*, which was engaged until September 19. The dredged material, consisting of sand, fire clay, gravel, shells, coal, and loose rock, was in great part dumped between the wing dams extending from the trailing dam at foot of Credit Island, but a considerable portion of the spoil was given to the contractors engaged in raising and enlarging the closing dam across the head of Rockingham Slough, and a small amount was cast on the adjacent banks.

The grade of the dredging was 5 feet below low water of 1864; the area covered, 298,450 square feet, and the total quantity dredged was 42,726.1 cubic yards. Average cost of dredging, including plant charges, 13½ cents.

Pile driver 104 commenced driving the piles for mooring purposes at section A on June 18, and the pile driving was continued on sections A, B, C, and on the cross lines of protection piling, until September 12. The piles, which were of white oak, 14 inches in diameter at the butts, were chained together in clusters or bunches. Two alternating rows of protection piling in clusters of 5, 50 feet apart, were driven across the slough just above the upper mooring sites. Mooring piles were driven the entire length of the three selected locations in clusters of 3 piles, about 60 feet apart.

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The depth to which the piles were driven before rock was encountered varied from 6½ to 11 feet, but those of insufficient penetration were afterwards reenforced with dredged material.

The dam across the head of Rockingham Slough, which had been raised by the United States in 1903 to a crest elevation of 8 feet above low water, was still further raised to an elevation of 13 feet by the Davenport Suburban Railway Company, which placed tracks on it to connect the Iowa shore with a pleasure resort on Credit Island. This dam, which is now high enough to prevent any river ice from running through the slough, is of great strength, and will doubtless be maintained in good condition in the future by the railway company.

To prevent a field of ice (about 1 mile in length, extending from the closing dam at the head of the slough to the upper limits of harbor sites A and C) from moving down and doing damage to boats and barges in the harbor, two rows of protection piles were driven as above described, and it is thought that no trouble can come from the ice in the slough; 124 protection piles were driven.

For mooring purposes, and to prevent boats from going aground, piles were driven in bunches of 3 on or near the low-water line along the three mooring sites in such a manner that deep water exists just outside the piling. The three mooring sites may be briefly described as follows: "A," on the Iowa shore, commencing just below the protection piling and at the point where the Rockingham road first touches the slough, and running downstream 1,130 feet, with 23 clusters of piling about 50 feet apart; "B," on the Iowa shore, running up from a point nearly opposite the foot of Credit Island, 1,700 feet, with 29 clusters of piling, about 60 feet apart; "C," on the island shore, commencing just below the protection piling and running downstream about 700 feet, with 12 clusters of piling, about 60 feet apart. These harbors are sufficient in extent to accommodate all the boats engaged on this portion of the river, but it is feared that little or no advantage will be taken of them.

The amount of material dredged at each harbor site was as follows: At "A," 17,453.8 cubic yards; at "B," 14,813 cubic yards, and at "C," 10,459.3 cubic yards; total, 42,726.1 cubic yards. This amount is about 13,000 cubic yards less than was estimated in the project, due to the necessary curtailment in length of the harbors by meeting with solid rock, which the dredge could not remove.

Summary of items of cost of construction of ice harbor below Davenport, Iowa.

Raising Dam No. 1	$3,256.18
Mooring and protection piles	2,907.84
Dredging	4,000.95
Superintendence, engineering, and contingencies	1,534.54
Total	11,699.51

HARBOR AT MUSCATINE, IOWA.

The river and harbor act of June 13, 1902, provides "the sum of ten thousand dollars, or so much thereof as may be necessary, for the improvement of the harbor at Muscatine, Iowa."

This appropriation was made without any reference to this office or prior survey. An examination made in August, 1903, showed that the dredged area of 1897–98 had not filled up, and that the harbor was in excellent condition so far as depth of water was concerned, and it so remains at the present time.

At the instance of the Muscatine city council a project was submitted October 25, 1904, providing for about 800 linear feet of riprap shore protection and 5,000 square yards of brick or stone paving.

Estimate.

5,000 square yards brick or stone paving, at $1.60	$8,000
800 linear feet riprap shore protection, at $2.50	2,000
Total	10,000

Of the above estimate, the riprap only was approved by the Chief of Engineers. It is proposed to perform the work at a favorable opportunity.

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FLINT CREEK TO IOWA RIVER LEVEE.

[Miles 411 to 440 on the upper Mississippi River.]

During the fall of 1904 thorough repairs were made to all of the wooden outflow valves and the masonry supporting them. Many of the valves were badly broken or warped, and a few of them lost. Repairs were also made to portions of the embankment where the earth had sloughed away. In November a thorough inspection of the entire levee was made. This inspection developed the need of extensive repairs to the earthwork, revetment, and shore protections, as well as considerable new shore protection along the Iowa River and in Iowa Slough.

BUOYS.

Buoys were placed as usual to mark the location of the ends of certain dams that are dangerous to raft navigation at stages when the crests of the dams are covered with water to a depth of less than 3½ feet.

The regular buoys in this division are 13 in number.

IN GENERAL.

The localities in this division most in need of improvement appear to be above Keithsburg Bridge (mile 416), at foot of Muscatine Prairie (mile 397), below Muscatine (miles 391–392), and at Johnsons Island (mile 424). The following-named work is also recommended, viz: The protection of the east bank of Turkey Island (mile 406) for about 3,000 linear feet; of the Illinois shore opposite Turkey Island and below, about 10,000 linear feet (miles 407–408); of the Illinois shore between New Boston and Keithsburg (mile 416), 3,000 feet, and of the Illinois shore in the vicinity of Johnsons Island (miles 422–424), about 10,000 feet. The protection of the Iowa shore below Port Louisa should be extended about 1,500 feet and the old work repaired (miles 404–405). A series of short wings from the Iowa shore above Fairport (mile 381) is desirable to keep the channel away from the flat, rocky shore. The chute between Islands 348 and 349 (mile 402) should be closed to prevent a too great diversion of the channel water and the Iowa shore opposite protected.

Very respectfully, your obedient servant,

C. W. DURHAM,
Principal Assistant Engineer.

Maj. JAS. L. LUSK,
Corps of Engineers.

REPORT OF MR. M. MEIGS, UNITED STATES CIVIL ENGINEER.

UNITED STATES ENGINEER OFFICE,
Keokuk, Iowa, February 1, 1905.

MAJOR: I have the honor to submit the following report of operations for improving the Mississippi River in the division in my local charge, extending from Burlington, Iowa (mile 442), to Hannibal, Mo. (mile 541), for the calendar year 1904:

BURLINGTON TO HANNIBAL.

Under project approved April 6, 1903, and allotment of $35,000 from appropriation of March 3, 1903, Contractor Albert Kirchner resumed operations May 2, 1904, under contract dated July 14, 1903, and finished the contract on June 30, 1904. The prices paid under this contract were $1.39 per cubic yard for rock and 58 cents per cubic yard for fascines. The work done under this contract was the construction and repair of dams and shore protections between Keokuk and Hannibal. One dam, No. 29 (mile 532), was built 1,400 feet above Dam 28, from the Missouri shore at Whitneys bar, completing the system at that locality. The fleet was then moved to Fabius Island (mile 527), where 1,950 feet of shore protection was repaired. On May 23, the fleet began repairs to the shore protection of La Grange Prairie (mile 515), and on Illinois shore opposite Cottonwood Island (mile 519). During May repairs were also made to the shore protection below Quincy Bridge (mile 521). In June, Dams 20 (mile 522) and 21 (mile 521) were built. Dam 20 is of light construction, consisting largely of fascines, and was built to induce deposit between Dams 1 and 14. Dam 21, 930 feet long, was built to retain the sand deposited by suction dredge

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Hecla. It was of the lightest fascine construction and was buried in the sand as fast as built. The proportions of fascines to rock in this dam was about 1 of rock to 4 of fascines. This dam was afterwards lengthened 260 feet, to prevent scour around the end of the shore protection above Quincy bar. Shore protection for 2,487 feet in length was repaired on Island 419 (mile 511). The contract was finished on June 30, 1904, and the plant was then removed to the vicinity of Clinton, Iowa.

List of works constructed and of materials used during the season of 1904 under contract dated July 14, 1903, with Albert Kirchner, between Burlington and Hannibal.

Designation.	Length.	Height above low water, 1864.	Rock.	Fascines.
	Feet.	*Feet.*	*Cubic yds.*	*Cubic yds.*
Sheet 66 (miles 504–513): Shore protection on Island 419, repaired	.....	15	1,408.1	.....
Sheet 67 (miles 513–520):				
Shore protection on La Grange Prairie, repaired	.....	18	331.8	.....
Shore protection on Lone Tree Prairie, repaired	.....	18	1,982.5	.....
Shore protection opposite Cottonwood Island, repaired	.....	18	527.8	.....
Sheet 68 (miles 520–529):				
Shore protection at West Quincy, repaired	.....	14	1,455.9	1,523.6
Wing Dam 21	930	10	746.7	3,180.1
Wing Dam 20	1,000	.....	556.6	1,744.9
Sheet 70 (miles 530–538):				
Shore protection on Island 431, repaired	.....	18	899.7	.....
Wing Dam 29	600	6	2,192.7	4,791.9
Total	.....	.....	10,101.8	11,240.5

Financial statement for work performed in 1903 and 1904 between Burlington and Hannibal under contract dated July 14, 1903, with Albert Kirchner (entire contract).

Amount paid contractor		$32,968.18
Cost of local inspection, etc.		1,326.83
Quota of general superintendence and office expenses		1,325.43
Add for use and deterioration of plant		40.17
Total		35,660.61
Material put in works:		
Rock	cubic yards	15,872.3
Fascines	do	18,802.9
Total	do	34,675.2
Average cost per cubic yard in place		$1.028
Average cost per cubic yard for inspection		.038

Under project approved May 21, 1904, and allotment of $35,000 from appropriation of April 28, 1904, contractor Albert Kirchner commenced operations August 11, 1904, under contract expiring August 25, 1905, and completed this contract October 30, 1904, laying up his fleet at Quincy Bay. The prices paid under this contract were $1.35 per cubic yard for rock and 53 cents per cubic yard for fascines. The work during the season of 1904 was the completion and extension of certain shore protections, and the building and repairing of certain dams between Keokuk and Hannibal. Six hundred and twenty feet of new shore protection on the Missouri shore (mile 491) was built, and 5,400 feet of shore protection below Alexandria and on Fox Island was raised to top of bank. This latter shore protection, which had never been raised to full height, had, in the course of years, been flanked in places by the river and had a very flat slope behind it. Dam 6 (mile 491), 1,400 feet long, was raised to a 4-foot stage. A sand bar at the end of this dam occasioned the most difficult navigation in the division for a few days. Raising the dam, which had settled to about a 1.5-foot stage, soon scoured out the obstruction. Dam 3 (mile 490), a closing dam at the head of Fox Slough, was repaired and restored to a 4-foot height above low water. New shore protection, 2,400 feet in length, was built and old shore protection 2,100 feet long was raised to the top of bank on the Missouri shore (miles

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500–502). Wing Dam 21 (mile 521) was extended 260 feet on the Illinois shore at foot of Quincy Bay. After being buried in sand from the suction dredge *Hecla* this same dam was completed with 960 feet of shore protection on the lower side of the dam. The dam was of light construction in order to retain the sand pumped by the dredge. The shore protection extended to 13 feet above low water in order that the river, in flood times, might not overtop the sand dredged and again deposit it in front of the steamboat landing. At Curtis Point, on the Missouri shore (mile 500), 900 feet of new shore protection was finished to top of bank, and 1,500 feet to an 8-foot stage only. Wing dams 8 (mile 501) and 9 (mile 500) were partly finished. These dams were built the full length, but the exhaustion of the allotment prevented the entire completion of the work.

List of works constructed and repaired and of materials used during the season of 1904, under contract dated August 11, 1904, with Albert Kirchner, between Burlington and Hannibal.

Designation.	Length.	Height above low water, 1864.	Rock.	Fascines.
Sheet 63 (miles 484–492):	*Feet.*	*Feet.*	*Cub. yds.*	*Cub. yds.*
Shore protection below Alexandria, raised		15	448.9	
Shore protection on Illinois shore opposite Fox Island, repaired			71.7	
Closing Dam No. 3, repaired		4	264.2	186.4
Shore protection on Fox Island, raised (5 to 15 feet)		15	1,143.5	1,000.7
Shore protection on Fox Island	620	15	1,409.8	1,415.2
Wing Dam No. 6, repaired		4	927.8	2,409.0
Wing Dam No. 8, repaired			190.6	183.0
Sheet 64 (miles 492–499):				
Wing Dam No. 4, repaired			280.1	291.6
Wing Dam No. 5, repaired			384.5	345.1
Sheet 65 (miles 499–504):				
Wing Dam No. 9	1,100	4	783.8	2,445.7
Shore protection at Curtis Point	2,400	13	4,445.0	5,459.5
Wing Dam No. 8	2,000	6	2,029.8	5,729.9
Shore protection at Curtis Point, raised		13	1,915.0	
Sheet 68 (miles 520–529):				
Shore protection at West Quincy			95.3	
Wing Dam No. 21, extension	260	8	283.0	1,202.8
Shore protection at Quincy bar cut	960	14	1,802.7	2,827.4
Levee at St. Charles Bay, repaired			144.6	
Total			16,600.3	23,496.3

Financial statement for work performed in 1904 between Burlington and Hannibal, under contract dated August 11, 1904, with Albert Kirchner.

Amount paid contractor:		
From general appropriation		$29,911.75
From Quincy bar allotment		4,951.70
		34,863.45
Cost of local inspection, etc		777.20
Quota of general superintendence and office expenses		1,095.79
Add for use and deterioration of plant		39.52
Total		36,775.96
Material put in works:		
Rock	cubic yards	16,600.3
Fascines	do	23,496.3
Total		40,096.6
Average cost per cubic yard in place		$0.917
Average cost per cubic yard for inspection		.019

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BAR AT QUINCY.

Work was carried on under a project of Maj. Jas. L. Lusk, dated October 2, 1903, and under the following allotments: Sundry civil act, March 3, 1899, "Removing Sand Bar at Quincy," balance, $6,819; same act, "Dredging Channel at Quincy Bay," balance, $1,363; and river and harbor act of June 13, 1902, "Improving Quincy Bay and Removing Sand Bar," $20,000. The estimate under this project was as follows:

Dredging and removing 30,000 cubic yards mud and sand at mouth of bay, at 15 cents	$4,500
2,500 linear feet riprap, at $2.50	6,250
Suction dredge working on bar outside of line B C D, including the brush bulwarks, a few days' work of dipper dredge, and contingencies	17,250
Total	28,000

The bar in front of the Quincy steamboat landing has been gradually encroaching on the steamboat channel since about 1890. It was formed by a gradual movement of sand following the Illinois shore above Quincy, the progress of which is clearly shown by surveys made at intervals since 1882. The lower end of the bar had enveloped the steamboat landing so that boats had to back down quite a distance after touching Quincy, in order to get room to resume their voyage. There was no lack of depth next the shore, but the channel had become narrow and there was fear that it would finally close in on the landing and shut it out. Another difficulty was that the progress of the bar had, at low water stages, cut off the city waterworks from a supply of pure water, nothing going into the intake when the bar was out of water but the backwater from Quincy Bay, much contaminated with sewage and constituting a menace to the health of the city. The two considerations united made the call for relief very persistent and loud.

A relief was attempted in 1896 by dredging a 100-foot cut through the dry bar at the foot of the bay and riprapping the upper side of the cut. This channel was about 6 feet below low water and 100 feet wide. The protection put on the slopes was mostly of brush, with just enough rock to sink it, and the top of this protection was at a level with the crest of the bar, about 3 feet above low water. This cut had a direction not far from perpendicular to the direction of the main current of the river. During the year of its construction it answered its purpose and washed away the filthy water from the intake of the waterworks and the water from near the landing. It was but a short time, however, before a high water occurred, which, sweeping across it, soon filled the cut with sand, and thereafter the brush, being firmly anchored in the sand, resisted any deepening of the bar and even tended to add to the accumulations.

To remove the bar radically, it was therefore planned, first, to erect a dam of light brush and rock construction extending at an angle with the current from the foot of Quincy Bay until it reached the 1,300-foot channel line of the main river, this dam to be carried up to the highest of the ordinary river banks, 13 feet above low water. Then it was planned to make a cut 200 feet wide with the suction dredge below this dam and pump the sand over the dam to its upper side, where it could never again get into the cut. It was thought that this cut being made, the current would draw through it and attack the bar on all sides, gradually washing it downstream by the force of the river itself, and occasioning the least possible expense in the removal, as the force of the river would be utilized. Accordingly, the suction dredge *Hecla* was commissioned to do the dredging, and, after a preliminary trial in September and October, 1903, various changes in her machinery were found to be desirable and were made during the winter of 1903–4. The dredge began work May 10, 1904. It was attempted at first to build out a wing dam of sand from the shore, without any brush, to catch and hold the sand after it was pumped. This attempt was found abortive. The sand, pouring from the discharge pipe into water, was found to have such a very small specific gravity that it would almost float. Great masses of it could be seen from time to time breaking away and floating off downstream, and it was discovered that, even when the deposit kept several hundred feet above the line of the cut, it was not long before the sand flowed back into the excavated channel and had to be pumped over again. Such deposits of sand, when brought to the surface, for some time retained the properties of quicksand, and to walk over it meant to be instantly mired down, nor could one extricate himself without assistance. On the other hand, when the deposit reached such a height that the discharge poured, not into the water, but onto the sand bank above water, the deposit was like beach sand, firm

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and hard, so that it could be walked over without any sinking in at all. It is probable that the reason for the flotation of the sand when deposited in the water is that each of the particles becomes enveloped by an adhering film of air, making it excessively light, while that pouring onto a sand bar above water and running down a slope of sand loses this air and becomes at once a compact mass. Whatever the cause, it was soon found necessary to build a light barrier of brush below the sand deposit, to restrain this flotation. Wing Dam 21 (sheet 68, mile 521) was therefore built on the upper margin of the cut to be made. The largest amount of brush was used that could be readily sunk, and it filled with sand almost as fast as it was built. This dam was made a part of the project for improving the river, and the force of Contractor Albert Kirchner was utilized for the purpose, at the contract prices prevailing, namely, for rock, $1.35 per cubic yard, and for brush 53 cents per cubic yard. This dam was built between June 9 and 23 to a length of 930 feet, and in September an extension of 260 feet was added, to cut off a current that was found to be working disadvantageously around the upper end of the dam.

The work of the dredge was found to be far more satisfactory after certain changes had been made in her machinery. The percentage of sand in the discharge rose from about 1 or 2 per cent to as high as 24 per cent at times, though a satisfactory average was found to be about 10 per cent. Two different patterns of runner were tried. The Edwards runner, with three blades and shrouds, was found to give the best percentage of sand. This runner, however, was of ordinary cast iron and would not last more than a week before some stone in the discharge would fracture the blades and shrouds beyond repair. A five-blade open runner with renewable blades gave much better results as regards durability, but had considerably less efficiency. The percentage of sand lifted with the open runner rarely got above 15 per cent, and yet its practical virtues made it more desirable than the less durable but more efficient three-blade runner. There were constant tests made of the discharge from the pump by means of a cock situated halfway up the side of the discharge pipe where it issues from the pump and where it is thoroughly united with water by the action of the runner. Tests at top, bottom, and sides of this pipe show that the halfway cock gave a fair average of the entire discharge. It was most useful for studying the character of the discharge at any time and the influence upon it of various forms of stirring jets and suction heads. The tabulation of all the observations for percentage of sand made with this cock gave an average of about 9½ feet per second. Both the percentage and the velocity are less than what should be obtained, but to get these percentages taxed severely the capacity of the boilers. Tests of different coals were made from time to time, and it was discovered that the lowest-priced coals were not the cheapest. It seems certain that with the present Scotch boilers installed, it will always be a difficult matter to make steam enough, and only the best of coal will show good results in work accomplished.

The output of the dredge was estimated by observed percentages and velocities. It is certain that these estimates were on the whole somewhat high. There was a great waste of time at every move of the dredge when the suction was raised and only clear water being pumped, and this could not well be allowed for. The loss of time from breakdowns, choking of the suction, and such matters amounted to often 50 per cent of the time under steam. Such a dredge should be made to move without raising the suction, so that the work would be continuous. Such a suction is now being prepared for her next season's work.

After the sand taken from the cut had been raised to a height of about 10 feet above low water, scrapers were used to make a ridge or levee on the upper line of the cut about 4 feet wide on top with 1 on 2 slopes, and these slopes and the slopes on the upper side of the cut continuous with the levee were covered with brush and rock. The object in thus raising the height of the sand deposit was to prevent high water from sweeping the loose sand back into the cut. In a few years all this area will be covered with willows, and such action is no longer to be feared. The length of this shore protection on the upper side of the cut was 960 feet, with the 260 feet of dam extending above it already mentioned.

From July 12 to September 6, 1904, the *Hecla* was at work in the Des Moines Rapids Canal, and removed two sand bars that had formed at the mouths of two creeks and threatened navigation. On September 7 the dredge and tender returned to Quincy and worked continuously up to October 27, removing the bar and piling it up behind Dam 21. The result of the dredging operations is a channel between the bar and Dam 21, which is 1,200 feet long. At low water it is 400 feet wide; at 4½ feet below low water it is 200 feet wide, and at 6 feet below low water it is 100 feet wide. The current through this cut was very strong at stages of the river of 5 feet above low water and less, and the movement of sand from scour was rapid. The results of the work seem to be all that could be expected in such a short time. The bar below

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Dam 21 has shrunk from an area of 832,000 square feet at low water to 451,000 square feet, or nearly 50 per cent, measured November 7, 1904, when the last survey was made. Area dredged, 413,950 square feet; cubic yards dredged, 279,310; time spent in pumping, 960 hours; total time lost, 393 hours.

Between April 19 and May 12, 1904, pile driver *No. 104*, with launch *Louise* were employed in driving mooring piles, 100 feet apart, to mark the line of the proposed dam (No. 21) and to fasten the dredge and barges to. On May 12 the pile-driver outfit was discharged and went to Fort Madison, to drive piling for the new pier at Fort Madison Bridge. The number of piles driven at Quincy bar was 21.

DREDGING QUINCY BAY.

Under authority of project approved October 12, 1903, an emergency contract, dated December 4, 1903, expiring August 31, 1904, was made with H. S. Brown for removing the deposit which had collected in the vicinity of the lower railroad bridge at the entrance of the bay, where two sewers had built up considerable of an obstruction. The old brush mattress below Dam 21 (sheet 68) was also removed, at an expense of $350, and a burned steamboat wreck was taken out near the west abutment of the railroad bridge where it had sunk. One cut was made along the levee front from 150 feet above the Diamond Jo warehouse to the bridge, in addition to the deposit of the Broadway street sewer. Above the bridge an area of 100 by 40 feet was dredged to 6 feet below low water, and one cut was made along the west side of the draw rest. From August 5 to 19, 1904, the dredging was continued by widening the channel made by the *Hecla* where it joined that along the levee front, cutting off the corner of the bar where the *Hecla* could not reach for want of sufficient suction pipe.

Area dredged, 174,000 square feet; cubic yards dredged, 30,064.9.

Financial statements for Quincy Bay and bar at Quincy.

Removing bar by suction dredge *Hecla:*		
Labor	$3,658.41	
Fuel	3,148.01	
Subsistence	664.43	
Supplies	187.79	
Current repairs and sundry expense	753.30	
		$8,411.94
(Cost per cubic yard for material dredged, 3 cents.)		
Piling		379.91
Contract dredging at mouth of Quincy Bay (dipper dredge):		
30,064.9 cubic yards, at 15 cents per yard	4,509.73	
Inspection, etc	217.68	
		4,727.41
(Cost per cubic yard, 15.7 cents.)		
Building Dam 21 (sheet 68) and shore protection:		
Rock and brush in place	4,951.70	
Labor and team hire	141.50	
		5,093.20
Removing old brush mattress below Dam 21 (70 hours' work of dredge, at $5 per hour)		350.00
Add:		
General superintendence and office expenses		250.00
Freight paid on lumber for barge *207*		176.48
Total		19,388.94

SURVEYS.

In November surveys were made in the vicinity of Montrose (miles 469–472), vicinity of Curtis Point (miles 498–501), and vicinity of Quincy (mile 521). Other surveys were made from time to time, incidental to the progress of dredging at Quincy bar.

IN GENERAL.

The general high water prevailing during the working seasons of the past two years has prevented the dressing of the tops of all dams built during that period. The showing made during a brief period of low water, when, for a few days, some of these dams were exposed, indicates that they are substantially at grade and need

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only light trimming to put them in first-class condition. The shoalest water developed in this district during the year was at the end of Dam 6 (mile 491), where, for a few days, the depth was only 4.5 feet. The repairs to the dam, raising it to a 4-foot stage, restored a good channel. A second shoal developed at Curtis Point (mile 501), where the channel is in a state of change. The construction of Dam 8 (mile 501) will in all probability eliminate this shoal.

The contractor, Mr. Albert Kirchner, showed commendable energy in the execution of both his contracts, working, as he did, under many difficulties due to the high water and trouble in securing fascines during a large part of the season.

Mr. W. T. Pierce, inspector, and assistant, Mr. Josef Mershon, deserve commendation for faithful and efficient performance of their duties.

Very respectfully, your obedient servant,

M. MEIGS,
United States Civil Engineer.

Maj. JAS. L. LUSK,
Corps of Engineers.

REPORT OF MR. A. L. RICHARDS, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Rock Island, Ill., January 17, 1905.

MAJOR: I have the honor to submit the following report of operations for improving the Mississippi River between Hannibal and the mouth of the Missouri River, the division in my local charge, during the calendar year ending December 31, 1904:

HANNIBAL TO MOUTH OF MISSOURI RIVER.

The improvement of this section of the river was carried on under project approved May 21, 1904. This work was performed by hired labor and the use of Government plant, the U. S. towboat *Coal Bluff* doing the towing.

Brush, delivered on United States barges, was purchased under emergency contracts and written notices, without advertising, and was furnished by John C. Rupp, of Quincy, Ill., and H. Holmes, of Foley, Mo. The prices paid were 17, 17½ and 19 cents per cubic yard, delivered on United States barges.

Rock was delivered on United States barges at the quarries and towed by the United States. It was purchased under emergency contracts and written notices, and was furnished by the Grafton Quarry Company, of Grafton, Ill., and George W. Camery and Hanes & Camery, of Hannibal, Mo. The prices paid were 58, 65, 63, and 60 cents per cubic yard.

The working season opened July 8, and closed, owing to the allotment for this division having been expended, October 29, 1904.

The *Coal Bluff* and 30 pieces of plant were laid up for the winter in the harbor at Portage Island, where they will be repaired before being placed in commission next season.

Vicinity of Cuivre Island (mile 616).—Closing Dam 17 was built from near the head of Cuivre Island across the chute to Island 503. Wing Dams 7 and 8, built in 1898–99, were raised from 3 and 4 feet, respectively, to an elevation of 7 feet above low water.

Vicinity of Iowa Island (miles 627–631).—Wing Dam 27, built in 1898 to a 3-foot stage, was raised to an elevation of 7 feet above low water. Wing Dam 28, built in 1898, was leveled up. Wing Dam 32, from Illinois shore 950 feet below Dam 27; Wing Dam 33, from Illinois shore 825 feet below Dam 32, and Wing Dam 34, from Bolters Island, at a point 1,000 feet above Dam 9, were built. Wing Dam 35, from Bolters Island 1,300 feet above Wing Dam 34, and Closing Dam 36, from Enterprise Island to Missouri shore, were built. Closing Dam 9, built in 1894–95, was raised to an elevation of 8 feet above low water. The shore protection above head of Squaw Island was extended down river for a distance of 1,500 feet.

Vicinity of Grafton, Ill. (mile 635).—Wing Dams 24 and 25, built in 1895, were repaired at their shore ends. Closing Dam 32, built in 1895, was repaired.

Vicinity of Portage Island (miles 640–641).—Closing Dam 15, built in 1894, was repaired. Dam 48 (Portage roadway), built in 1897, was repaired at outer end.

Vicinity of Louisiana.—Repairs to ferry dike were completed.

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List of works constructed and repaired and of materials used during the season of 1904 between Hannibal and mouth of Missouri River.

Designation.	Length.	Height above low water, 1864.	Rock.	Fascines.
Sheet 81 (miles 615–616):	*Feet.*	*Feet.*	*Cub. yds.*	*Cub. yds.*
Closing Dam 17	560	7	2,301.6	3,525.7
Wing Dam 7, repaired	.....	7	1,865.4	3,038.5
Wing Dam 8, repaired	.....	7	1,820.9	2,464.8
Sheet 83 (miles 627–631):				
Wing Dam 27, raised	.....	7	1,118.9	2,475.2
Wing Dam 32	700	7	1,620.1	2,271.4
Wing Dam 33	250	7	941.2	1,454.7
Wing Dam 34	800	7	4,299.0	8,335.6
Wing Dam 35	400	7	2,455.7	5,598.4
Closing Dam 36	1,150	7	4,861.1	8,350.7
Closing Dam 9, raised and repaired	.....	8	2,229.8	3,535.6
Shore protection, Squaw Island, extended	1,500	4–18	2,198.6	3,324.4
Sheet 84 (miles 635–641):				
Wing Dam 24, repaired	.....	.....	63.5	.....
Wing Dam 25, repaired	.....	.....	146.3	.....
Closing Dam 32, repaired	.....	8	2,744.8	3,535.5
Closing Dam 15, repaired	.....	8	2,932.4	4,174.8
Dam 48 (Portage roadway), repaired	.....	8	121.8	.....
Total	.....	.....	31,721.1	52,085.3

Financial statement for work of constructing dams and shore protections between Hannibal and mouth of Missouri River, performed by hired labor, during season of 1904.

Amount expended in field during calendar year 1904		$46,054.27
Add quota of general superintendence and office expenses		1,644.63
Plant charge		5,271.43
Total		52,970.33
Material put in works:		
Rock	cubic yards	31,721.1
Fascines	do	52,085.3
Total	do	83,806.4
Agerage cost per cubic yard:		
On barges		$0.339
For towing		.073
For putting in place		.109
For local superintendence and office expenses		.026
For general superintendence and office expenses		.019
For plant		.061
		.627

CHANNEL AND HARBOR AT HANNIBAL.

An emergency contract for improving the harbor at Hannibal, Mo., by dredging, was entered into September 8, 1903, with H. S. Brown, of Quincy, Ill., for dredging 30,000 cubic yards of material, at 15 cents per cubic yard, from in front of the steamboat and ferry landings at that city.

This work, which was discontinued October 3, 1903, on account of high water, was again resumed August 23, 1904, and continued until September 22, when the contract was completed.

During the season the dredging was carried to the required grade of 4.5 feet below low water, and 24,609.8 cubic yards of material were removed.

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SURVEYS.

During the season, surveys were made in the following localities: From head of Slim Island to foot of Portage Island (miles 637–641); vicinity of Iowa Island (miles 626–631); vicinity of Stag Island (miles 603–605); vicinity of Hamburg, Ill. (miles 589–593), and from Gilbert Island to head of Hickory Chute (miles 550–561). In all a total distance of 24 miles of river was surveyed, and the notes are now being plotted in this office.

IN GENERAL.

The stage of water during the entire season was very favorable for construction work, which advantage materially decreased the cost of construction as compared with the last three seasons' operations, during which time the river was at an excessively high stage.

The most noticeable results were obtained this season in the vicinity of Iowa Island. The river at this point was in very bad condition, threatening to be the head of navigation. Four new wing dams were built at this point and two old ones repaired, and at the time the first dam was completed a noticeable improvement in the channel was evident, and by the time all the dams were built the channel was in excellent condition, and will remain so as long as the constructed work is kept in good repair. No work was done in the vicinity of Stag Island, as the survey at that point indicated that the channel was not in the proper position to permit of improvement at that time, and it is in fair condition at present.

The total length of works constructed under day-labor work during the season of 1904 is as follows: Dams, 3,860 feet; shore protection, 1,500 feet.

The day-labor work next season will probably be confined between the head of Gilbert and North Fritz islands, as the surveys indicate that this stretch is in great need of improvement, and the channel is now in the proper position to be regulated.

No work was done on the Fetter & Crosby contract, but it is intended to work out this contract early next season, confining the work mostly to shore protection in the vicinities of Pharrs and Mosiers islands.

It will be necessary to establish a new winter harbor for the fleet of this division (or dredge out the one now in use), as the present harbor at Portage is accessible only at high stages of water, it being entirely landlocked at present.

Very respectfully, your obedient servant,

A. L. RICHARDS,
Assistant Engineer.

Maj. JAS. L. LUSK,
Corps of Engineers.

REPORT OF MR. C. W. DURHAM, PRINCIPAL ASSISTANT ENGINEER, ON PLANT.

UNITED STATES ENGINEER OFFICE,
Rock Island, Ill., February 9, 1905.

MAJOR: I have the honor to present the following report on the condition, etc., of the floating stock or plant belonging to the improvement of the Mississippi River between the mouth of the Missouri River and St. Paul, December 31, 1904.

In this report "good" is in fine condition, wanting slight repairs or none; "fair" requires extensive repairs or such as are advisable; "bad" should be condemned or rebuilt. Pieces condemned during 1904 are omitted.

The plant in question is as follows: One large towboat (*Coal Bluff*), good; 2 medium-sized towboats (*Fury, Alert*), good; 1 medium-sized towboat (*Vixen*), bad; 4 small towboats (*Ruth, Ada, Elsie, Lucia*), good; 2 small towboats (*Mac, Emily*), fair; 1 small towboat (*Louise*), bad; 1 gasoline launch (*Myra*), good; 1 gasoline launch (*Edith*), bad; 1 dipper dredge (*Phoenix*), good; 1 dipper dredge (*Vulcan*), fair; 2 suction dredges (*Hecla, Geyser*), good; 1 dump boat, good; 3 dump boats, fair; 1 steam-drill boat, good; 1 steam-drill boat, fair; 1 steam-drill boat, bad; 21 pontons, good; 1 pile driver, good; 2 pile drivers, fair; 6 large quarter boats, good; 5 large quarter boats, fair; 1 large quarter boat, bad; 5 small quarter boats, good; 3 small quarter boats, fair; 2 small quarter boats, bad; 4 large office boats, good; 9 small office boats, good; 4 small office boats, fair; 1 small office boat, bad; 1 derrick boat, good; 1 derrick boat, bad; 2 store boats, good; 1 store boat, fair; 5 building boats, good; 1 building boat, bad; 36 large barges, good; 44 large barges, fair; 6 large barges,

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bad; 2 small barges, good; 3 small barges, fair; 1 small barge, bad; and a large number of grasshoppers, loading boats, powder boats, and skiffs, mostly in good condition.

To the snag-boat service belongs the side-wheel steamer *Colonel A. Mackenzie*, good.

The Des Moines Rapids Canal has a small plant, consisting of 1 small towboat (*Grace*), good; 1 small towboat (*Stella*), bad; 1 gasoline launch (*Madge*), good; 1 dipper dredge (*Ajax*), fair; 4 dump boats, good; 1 small barge, good; 2 small barges, fair.

The western section Illinois and Mississippi Canal has 1 gasoline launch, good, and 1 large barge, good.

There has been expended on the plant belonging to general improvement, to December 31, 1904, $1,009,867.34, and its estimated value on January 1, 1905, was $148,091.74.

Very respectfully, your obedient servant,

C. W. DURHAM,
Principal Assistant Engineer.

Maj. JAS. L. LUSK,
Corps of Engineers.

Y 3.

OPERATING AND CARE OF DES MOINES RAPIDS CANAL AND DRY DOCK.

The Des Moines Rapids Canal was open to navigation during the fiscal year 235 days, during which time there passed through it 928 steamboats and 285 barges, carrying 33,906 passengers, 14,451 tons of merchandise, and 3,700 bushels of grain. There also passed through the canal 17,190,000 feet B. M. of lumber, 4,475,000 feet of logs, 4,655,000 shingles, and 8,262,000 laths. This statement is about double that of 1904, the canal business in both years being much smaller than usual on account of the prevailing high stages of the river, which permitted most of the rafts and many boats to pass over the rapids outside of the canal.

The expenses of operating and care of the Des Moines Rapids Canal and dry dock have been during the past year $43,668.83, the same being provided for under an indefinite appropriation made by act of July 5, 1884. Nominal repairs were made to the locks and buildings. Dredging was carried on from July 1 to September 10 and from October 14 to November 15, 1904, and from April 17 to June 30, 1905, and amounted to 161,970 cubic yards, which makes the aggregate taken from the canal since June 30, 1878, 2,011,261 cubic yards.

The dry dock was in constant use.

Details of canal and dry-dock operations may be found in the report of United States Civil Engineer M. Meigs.

Money statement.

July 1, 1904, balance on hand ($3,538.31 unexpended)	$2,540.83
June 30, 1905, amount drawn from Treasury during fiscal year under indefinite appropriation	41,469.81
	44,010.64
June 30, 1905, amount expended during fiscal year	43,668.83
July 1, 1905, balance on hand ($6,645.86 unexpended)	341.81
July 1, 1905, outstanding liabilities	3,017.12

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ABSTRACT OF APPROPRIATIONS AND ALLOTMENTS.

By act approved—	
April 30, 1878	$7,500.00
June 18, 1878 (allotment)	32,500.00
March 3, 1879	40,000.00
June 14, 1880	30,000.00
March 3, 1881, expended during fiscal year ending—	
June 30, 1882	41,771.17
June 30, 1883	77,926.79
June 30, 1884	43,283.42
July 5, 1884, expended during fiscal year ending—	
June 30, 1885	44,506.50
June 30, 1886	43,009.53
June 30, 1887	42,152.84
June 30, 1888	42,802.35
June 30, 1889	38,885.37
June 30, 1890	43,995.80
By act approved—	
July 5, 1884, expended during fiscal year ending—	
June 30, 1891	$44,998.20
June 30, 1892	43,968.92
June 30, 1893	57,057.21
June 30, 1894	55,356.48
June 30, 1895	41,052.80
June 30, 1896	37,555.21
June 30, 1897	33,440.54
June 30, 1898	38,504.95
June 30, 1899	35,118.85
June 30, 1900	39,120.73
June 30, 1901	48,595.91
June 30, 1902	41,805.50
June 30, 1903	40,623.37
June 30, 1904	45,161.69
June 30, 1905	43,668.83
Total expended.	1,174,362.96

Expenditures for operating and care of Des Moines Rapids Canal for fiscal year ending June 30, 1905.

Month.	Office and administration.				Canal and locks.			
	Salaries.	Supplies.	Miscellaneous.	Total.	Labor.	Supplies.	Current repairs.	Total.
1904.								
July						$195.32		$195.32
August	$750.00		$3.23	$753.23	$2,595.00	4.20		2,599.20
September	375.00		1.23	376.23	1,440.00	240.83	$89.10	1,769.93
October			18.15	18.15	124.50	186.68	221.47	482.65
November	750.00		1.46	751.46	2,685.00	120.25	1,903.03	4,708.28
December	525.00	$2.25	.46	527.71	981.01	28.13	390.52	1,394.66
1905.								
January	525.00			525.00	1,020.37	4.35	96.93	1,121.35
February	525.00		2.18	527.18	942.00	28.02	125.25	1,095.27
March	525.00		9.75	534.75	963.34	9.55	473.92	1,446.81
April	375.00			375.00	1,547.96	93.55	133.48	1,774.99
May		34.91	19.95	54.86		85.83	28.83	114.66
June	850.00		3.27	853.27	1,484.00	203.29	60.14	1,747.43
Total	5,200.00	37.16	59.68	5,296.84	13,783.18	1,145.00	3,522.37	18,450.55

Month.	Dredging canal.				Grand total.
	Labor.	Supplies.	Current repairs.	Total.	
1904.					
July	$1,286.06	$1,297.87	$525.67	$3,109.60	$3,304.92
August	2,586.32	504.05	1,285.86	4,376.23	7,728.66
September	173.00	1,292.90	1,687.05	3,152.95	5,299.11
October		325.99	1,071.29	1,397.28	1,898.08
November	1,427.90	234.57	178.45	1,840.92	7,300.65
December			75.84	75.84	1,998.21
1905.					
January			430.54	430.54	2,076.89
February			289.76	289.76	1,912.21
March		24.05	713.23	737.28	2,718.84
April	800.19	469.82	611.78	1,881.79	4,031.78
May		3.87	3.15	7.02	176.54
June	795.50	1,435.68	391.05	2,622.23	5,222.93
Total	7,068.97	5,588.80	7,263.67	19,921.44	43,668.83

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COMMERCIAL STATISTICS.

Traffic statement of the Des Moines Rapids Canal for the fiscal year ending June 30, 1905.

Month.	Boats up.	Boats down	Barges up and down.	Passengers.	Merchandise.	Grain.
1904.					*Tons.*	*Bushels.*
July	87	83	40	11,430	2,948	.....
August	81	86	69	5,488	2,304	2,700
September	71	80	47	6,343	2,284	1,000
October	72	68	33	3,728	1,432	.....
November	42	47	45	337	370	.....
1905.						
April	40	8	21	243	1,244	.....
May	68	23	11	2,590	2,257	.....
June	65	7	19	3,787	1,612	.....
Total	526	402	285	33,906	14,451	3,700

Month.	Lumber.	Logs.	Laths.	Shingles.	Lockage at one lock.
1904.	*Feet.*	*Feet.*	*Number.*	*Number.*	
July	8,040,000	.....	1,725,000	2,330,000	165
August	350,000	1,325,000	30,000	85,000	164
September	5,100,000	3,150,000	1,437,000	1,150,000	177
October	3,700,000	.....	5,070,000	1,090,000	130
November	.....	.....	.....	.....	66
1905.					
April	.....	.....	.....	.....	66
May	.....	.....	.....	.....	101
June	.....	.....	.....	.....	89
Total	17,190,000	4,475,000	8,262,000	4,655,000	958

Table showing amounts of material removed from the Des Moines Rapids Canal from June 30, 1878, to June 30, 1905.

	Cubic yards.		Cubic yards.
1879	8,700	1894	58,025
1880	39,277	1895	.....
1881	9,003	1896	48,128
1882	67,789	1897	57,269
1883	113,575	1898	54,551
1884	52,616	1899	48,148
1885	38,097	1900	102,208
1886	65,970	1901	149,948
1887	78,537	1902	131,786
1888	47,333	1903	107,221
1889	86,278	1904	130,679
1890	23,830	1905	161,970
1891	46,751		
1892	149,818	Total	2,011,261
1893	113,954		

NOTE.—Of the above total 152,169 cubic yards was removed by contract, 1,228 cubic yards was removed by teams, and the remainder, 1,857,864 cubic yards, was removed by United States dredge.

REPORT OF MR. M. MEIGS, U. S. CIVIL ENGINEER.

UNITED STATES ENGINEER OFFICE,
Keokuk, Iowa, July 1, 1905.

MAJOR: I have the honor to submit the following report on "Operating and care of the Des Moines Rapids Canal" during the fiscal year ending June 30, 1905:

The canal was closed for the winter on November 20, 1904, and opened for the season's navigation April 1, 1905, being open 235 days and closed 130 days. Like last year, the stage in the river has been unusually high, though the flood of June, 1905

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(18.4 feet), did not attain the great height it did in 1903. The high stage of water has permitted much of the traffic to pass over the rapids, and hence it does not show in the traffic statement. One serious flood occurred in the canal, June 10, 1905, that surpassed all previous experiences. In a few hours, on the night of June 9, there fell an amount of water amounting to 12 inches or more. A cubical box, of 12-inch dimensions, which stood in an open place on one of the canal dredges, was more than filled during the night. The sluices at the middle and lower locks were of little use, as the water rose so suddenly that the men were driven from the sluice walls. An enormous flood poured into the canal from the three large and the several small creeks and escaped partly through the guard lock, whose gates, despite the high stage of the river, were forced open, and partly over the sluices and gates at the middle and lower locks, and the rest ran over the embankment from station 25 to station 32, considerably over a mile in extent. The dry dock was flooded at once by water pouring over the sides of the dock, and the U. S. light-house tender *Lily* and the U. S. towboat *David Tipton* were both lifted from the cradles. Fortunately no damage was done to these boats, as they settled back on the cradles where they had been placed, but the *Tipton* (only partly calked) was covered by the water and filled with mud, which had to be removed at considerable expense. The dry dock was filled with from 4 to 6 inches of mud, the removal of which will be expensive. The water swept across the dry-dock grounds about knee-deep, and some little lumber floated away into the river. Owing to the fact that the canal embankment is incased on both sides by a rock slope wall, very little damage, except from mud, was done by this cloud-burst. An enormous amount of mud was added to the deposits in the canal, and can only be removed by dredging. The mud in the dry dock will have to be removed by hand.

The flood reached the unprecedented height of 13.4 feet in the upper level of the canal, when 9.5 feet has hitherto been about the highest water known, and 8 feet is flood level. The upper gates at the middle lock were somewhat sprung, but can be straightened. The water was about 4 feet above the top of these gates, pouring into the lock chamber. On the whole, surprisingly little damage was done. At the lower lock the river rose 8 feet in about six hours, which is the record for rapidity of rise.

REPAIRS TO LOCKS.

But little lock repairs have been needed. Two combination timbers were replaced in the upper guard lock gates, and some decking was replaced in the upper gates of the middle lock.

The guard lock gates, rebuilt during the winter of 1890–91, can not be safely used another season, and should be rebuilt. The cost of this work is estimated at $6,500, including the two necessary cofferdams. The cost in 1891 was $5,700, but there has been a great advance in the prices of lumber and labor since that time.

At the lower lock several leaks, due to pitting, have developed in the hydraulic pipes on the east side of the lock, which have been repaired from time to time with clamps. Considering that the pipes have been underground twenty-eight years, they have given very good service, but it is thought that by occasional inexpensive repairs they may be made to last several years longer.

The lock buildings should be painted, as they have had no general painting for eight or ten years.

CANAL EMBANKMENT.

This embankment, 7½ miles long, has stood remarkably well for twenty-eight years without any serious leakage or breaks. The fact that it is incased with riprap stone on both sides no doubt has been the cause of its immunity from crevasses. It is only a levee of earth, and but for the stone on its outside would have been broken many times in its 28 years of life. The flood of June 10, 1905, flowed across it for a distance of a mile, as above stated, with but little damage other than the washing off of a small amount of earth from its top, which will have to be replaced.

DREDGING CANAL.

The extraordinary amount of deposit brought into the canal during the last fiscal year shows that either the allowance for dredging must be increased or the navigable width of the canal reduced, in order to keep up with the deposits.

The dipper dredge *Phœnix* and tender were employed in dredging the canal from July 1 to September 10, 1904, from October 14 to November 15, 1904, and from June 1 to 30, 1905. The hydraulic dredge *Hecla* worked from July 15 to September 6, 1904, and from April 18 to June 30, 1905.

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Two great storms occurred during the fiscal year, one in August, 1904, and one in June, 1905. These two storms deposited enormous quantities of mud in the canal. During the latter storm the water flowed into and over the dry dock for about six hours, leaving a deposit from 4 to 6 inches in depth. After each of these storms it was necessary to put the dredges at work at once at Prices Creek and Sandusky Creek to open navigation. The hydraulic dredge *Hecla* was found to be very poorly adapted to the removal of the creek bars and heavy deposit, which consists of the rock, gravel, and vegetable trash that drops immediately at the mouth of each creek. The stones break the pump and the trash clogs the suction. On the contrary, the dredge is admirably adapted to removing the mud that accumulates at greater distances from the outlet of each creek. During the winter of 1904–5 radical changes were made in the machinery of this dredge. The crane supporting the suction pipe was removed and the pump moved to the center of the boat, her suction being carried on a ponton 56 feet long and swinging on a pivot at the center of the length of the dredge. The other machinery was correspondingly altered and a double-spool winding engine was added to swing the ponton. As now arranged the suction makes a cut of about 95 feet in width. Various tests of the efficiency of the suction were made with results of from 10 to 75 per cent of mud. The average percentage of mud carried, reduced to the density of mud in the canal bottom (98 pounds per cubic foot), is 10 per cent. Nearly 50 per cent of the working time of the dredge is consumed in small delays to the machinery, shifting the pipe line, getting out of the way of steamers, repairing the runner and pump, etc. Could these delays be eliminated the output would be enormous compared with anything that has been done with dredges in the canal heretofore. As it is the expense is about half that with the dipper dredge, barring the stone and gravel immediately at the mouths of the creeks. The dipper dredge *Phœnix* is well suited to this kind of work, and as these bars are quite limited in extent and lie close to the mouths of the creeks, she has done efficient work in their removal.

One unexpected result of using the Sandusky sluice for getting rid of the dredged material has been observed: The upper level, from the guard lock to about 1 mile below, was found to have filled, in one season, with from 2 to 3 feet of mud. Evidently the large volumes of muddy water introduced into the canal when sluicing at Sandusky tend to neutralize the work done at a distance from the lock by causing new deposits. The large amount of stone that is picked up by the dredges everywhere in the canal has settled outside the sluice gates and formed a bar of an acre or more out in the river, shutting off in a great degree the efficiency of the sluice. It is evident that the sluice can not be used much longer for sluicing dredged material, and all must be either pumped by hydraulic dredge over the embankment or towed, as in former years, out into the river through the guard or lower lock. By far the larger part can be most cheaply removed by a hydraulic dredge. The dipper dredge will have to be relied on to take out the more solid deposits.

The following statement shows the localities where dredging was done and the quantities dredged during the fiscal year ending June 30, 1905:

	Cubic yards.
Above guard lock	5,840
Below guard lock	50,010
Vicinity of Ballingers	23,798
Vicinity of Sandusky	49,082
Vicinity of Prices Creek	22,982
Below lower lock	10,258
Total	161,970

This is the largest amount ever dredged during one year from the canal. The canal is dredged only sufficiently to keep it in good navigable condition, and at no time in its history has it had so much sediment in it as it has to-day. The dredging, while preserving navigation, has not kept up with the sedimentation. The pools that were below grade and needed no dredging are shortening year by year, as shown by the annual surveys, and the width of the canal prism is decreasing. All these point to the necessity for increased dredging in the future to keep up with the increasing muddiness of the river and creeks.

MACHINE SHOP AT LOWER LOCK.

During the winter months minor repairs were made to the snag boat *Col. A. Mackenzie*, towboats *Coal Bluff* and *Elinor*, launches *Lucia* and *Stella*, and dipper dredge *Vulcan*.

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Heavy work was done in the altering of hydraulic dredge *Hecla* from an end suction to a side suction dredge. A double-spool winding engine was built for this dredge, her pipe work changed and overhauled, pumps repaired, and two spud-hoisting cylinders built and installed. The position of the main engine was changed from the center to the end of the boat, and the Edwards pump was moved from the end to the center. Accordion joints were built for the flexible suction pipe, and a new 18-inch suction, supported on pontons, was substituted for the 15-inch suction originally used. As now arranged, the suction swings from a pair of connected pontons pivoted at the center of the length of the dredge, and is swung by a wire rope operated by a double-drum winding engine. A spud at each end, lifted alternately, allows for the progression of the dredge. The spuds are lifted by hydraulic cylinders operated from the boiler feed pump at a pressure of about 125 pounds.

The engines of the towboat *David Tipton* were overhauled and repaired where broken by the accident to her shaft and a new shaft was put on.

Heavy repairs were made to the machinery of dredge *Phœnix*.

A new dredge tender for the canal, the *Grace*, measuring 80 feet long, 17-foot beam, and with 7½-inch cylinders and lever engines, was completed, and a trial trip made in September, 1904.

One cylinder at the lower east side tower of the middle lock was repaired.

OPERATING DRY DOCK.

The dry dock was in operation the whole year. The new dredge tender *Grace* was launched July 29, 1904, and finished in September. The *Phœnix* was docked three times for minor calking and repairs to spud well. Dredge *Hecla* was docked to alter the position of her spuds, and a double ponton was built for her. The towboat *David Tipton* was in dock from November 19, 1904, to June 29, 1905, having her hull rebuilt with new sides, rake, and bow. The guard lock boom was docked all winter to dry out, and heavy repairs were made to its fence and counterbalances. The snag boat *Col. A. Mackenzie* was docked for calking and painting of the hull; also the U. S. light-house tender *Lily*, for calking and repairs to rudder. Coal flat *No. 54* had new rakes built and some calking done. Two commercial boats, the *Quincy* and *Dubuque*, of the Diamond Jo Line, were docked; the dockage fees amounting to $143.75.

On June 10, 1905, a great flood filled the dock by pouring over the gates, and a heavy layer of mud was deposited. The removal of this mud will be expensive. Some lumber floated away, and the *David Tipton*, which was on the ways, was filled with mud. Otherwise but little damage was done.

SURVEYS.

A complete survey of the canal was made April 11 and 12, 1905, and a resurvey was made June 22 1905, after the flood.

MISCELLANEOUS.

At various places trees growing on the canal embankment have been cut, and repairs have been make to the canal buildings when required. These buildings have not been painted for many years and all need a coat of paint.

I have been assisted by Mr. John R. Carpenter, superintendent; Mr. O. S. Willey, clerk, and Mr. W. T. Chambers, recorder, whose services have been uniformly satisfactory and efficient.

Very respectfully, your obedient servant,

M. MEIGS,
United States Civil Engineer.

Maj. C. S. RICHÉ,
Corps of Engineers.

Y 4.

IMPROVEMENT OF MISSISSIPPI RIVER AT MOLINE, ILLINOIS.

The river and harbor act of March 3, 1905, appropriates $100,000 for improving Mississippi River at Moline, Ill., in accordance with report submitted in House Document No. 397, Fifty-eighth Congress, second session (reprinted without map in Report Chief of Engineers,

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1904, pp. 2206–2215), and provides that contracts may be entered into by the Secretary of War for such materials and work as may be required to complete the project, to be paid for as appropriations may from time to time be made by law, not to exceed in the aggregate $286,000, exclusive of the amount herein appropriated.

The approved project comprises the construction of a lock and dam, with auxiliary rock excavation, and dredging of mud and sand. No through channel at present exists on the line of the proposed improvement.

The amount expended to June 30, 1905, was $792.36, used for designing and preparing plans for the lock and in repairing plant.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1905	$100,000.00
June 30, 1905, amount expended during fiscal year, for works of improvement	792.36
July 1, 1905, balance unexpended	99,207.64
Amount (estimated) required for completion of existing project	286,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	286,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

ABSTRACT OF APPROPRIATIONS.

By act approved March 3, 1905	$100,000

Y 5.

OPERATING AND CARE OF ILLINOIS AND MISSISSIPPI CANAL AROUND LOWER RAPIDS OF ROCK RIVER, AT MILAN, ILLINOIS.

During the past fiscal year the canal was in operation from July 1 to November 30, 1904, and from March 29 to June 30, 1905, a period of two hundred and forty-seven days, during eighteen of which Lock 37 was flooded. There passed through it 1,261 boats and barges, of an aggregate tonnage of 83,887 tons, carrying 2,310 passengers and 10,555 tons of merchandise. The traffic was much larger than that of the previous year, but will continue to be small until the coal mines are reopened.

Repairs to locks, gates, buildings, etc., were nominal. The south embankment, running west from the Mill Creek sluices, was raised to a grade of 138 feet opposite mouth of creek, and sloping to 135.5 feet at each end of the raised section, which was one-half mile in length. A section of the embankment 250 feet long was raised 8 inches. The revetment of both banks of the canal from Mill Creek to Lock 37 was thoroughly repaired. To prevent overflow of the village of Milan from Mill Creek, Water street was raised and widened for a length of 2,930 feet, to serve both as a levee and roadway. Considerable dredging was done at the Mississippi River entrance to Lock 37 and at the upper entrance of Lock 35.

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The expenses of the fiscal year ending June 30, 1905, were $13,601.96, the same being provided for under act of July 5, 1884.

The canal was in local charge of Mr. J. C. McElherne, assistant engineer.

There are no outstanding liabilities.

Money statement.

July 1, 1904, balance on hand	$391.53
June 30, 1905, amount drawn from Treasury during fiscal year under indefinite appropriation	13,248.47
	13,640.00
June 30, 1905, amount expended during fiscal year	13,601.96
July 1, 1905, balance on hand	38.04

ABSTRACT OF ALLOTMENTS.

By act approved July 5, 1884, expended:

During fiscal year ending—		During fiscal year ending—	
June 30, 1895	$225.00	June 30, 1902	$11,014.93
June 30, 1896	5,309.17	June 30, 1903	11,398.94
June 30, 1897	4,752.46	June 30, 1904	13,198.47
June 30, 1898	4,502.39	June 30, 1905	13,601.96
June 30, 1899	3,304.92		
June 30, 1900	5,379.84	Total	77,524.26
June 30, 1901	4,806.18		

Summary of expenditures for operating and care of western section, Illinois and Mississippi Canal, for fiscal year ending June 30, 1905.

Month.	Superintendence, office expenses, supplies, engineering, and contingencies.	Operating and care, locks and bridges.	Repairs.	Dredging.	Total.
1904.					
July			$27.84		$27.84
August	$17.75	$295.00	593.42		906.17
September	33.78	295.00	967.51		1,296.29
October	58.10	590.00	1,491.48		2,139.58
November	186.38	295.00	2,512.77		2,994.15
December	89.38	245.00	17.00		351.38
1905.					
January		249.31			249.31
February		245.00			245.00
March	9.00	248.33		$7.38	264.71
April			149.17		149.17
May	786.89	295.00		559.33	1,641.22
June	375.78	590.00	1,321.18	1,050.18	3,337.14
Total	1,557.06	3,347.64	7,080.37	1,616.89	13,601.96

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COMMERCIAL STATISTICS.

Traffic statement of western section of Illinois and Mississippi Canal for the fiscal year ending June 30, 1905.

Month.	Steamers.		Barges.		Number of passengers.	Tons of freight.	Lockages at three locks.
	Number.	Tons.	Number.	Tons.			
1904.							
July	139	2,679.5	69	11,820	366	1,794	315
August	144	2,269.7	54	9,010	620	1,885	266
September	68	564.4	10	690	366	.....	113
October	78	1,569.8	22	1,612	270	190	159
November	83	2,995.7	69	6,838	47	993	143
1905.							
March	3	10.0	.....	.....	8	5	7
April	81	2,750.0	44	6,917	140	1,057	210
May	115	3,436.0	113	20,370	192	3,910	385
June	120	2,997.0	49	7,358	301	721	170
Total	831	19,272.1	430	64,615	2,310	10,565	1,768

Statement showing amounts dredged from canal and approaches.

Location.	During year.	Total to date.
	Cub. yds.	*Cub. yds.*
Below Lock No. 37	10,554	61,946
Above Lock No. 35	891	4,595
Blossomburg Landing	.....	5,000
Crossing at Hilliers Island	.....	5,830
Total	11,445	77,371

Y 6.

OPERATING AND CARE OF GALENA RIVER IMPROVEMENT, ILLINOIS

During the past fiscal year the lock was open to navigation from July 1 to November 18, 1904, and from March 26 to June 30, 1905, a period of two hundred and thirty-four days, during eighty of which the lock was flooded by high water. There passed through it 2,162 boats and barges, carrying 10,628 passengers and 2,940 tons of merchandise. The traffic, although very small, was a little larger than that of the previous year.

Small repairs were made to lock, dam, and grounds, and a deposit of mud was removed from the upper entrance and chamber of lock.

A survey of the entire improvement was made in May, 1905, showing necessary dredging to the amount of 66,000 cubic yards to restore a 3-foot grade above the lock and 4 feet in Harris Slough.

The improvement was in local charge of Mr. J. C. McElherne, assistant engineer.

The expenses of the fiscal year ending June 30, 1905, were $3,833.28. There are no outstanding liabilities.

Money statement.

July 1, 1904, balance on hand ($3,082.51 unexpended)	$346.24
June 30, 1905, amount drawn from Treasury during fiscal year under indefinite appropriation	3,500.00
	3,846.24
June 30, 1905, amount expended during fiscal year	3,833.28
July 1, 1905, balance on hand ($2,166.72 unexpended)	12.96

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ABSTRACT OF APPROPRIATIONS AND ALLOTMENTS.

By act approved—	
September 19, 1890, purchase of improvement	$100,000.00
July 5, 1884, expended during fiscal year ending—	
June 30, 1894	635.68
June 30, 1895	6,000.00
June 30, 1896	3,400.00
June 30, 1897	8,588.20
June 30, 1898	5,890.05
June 30, 1899	3,226.87
June 30, 1900	8,750.94
June 30, 1901	12,077.01
June 30, 1902	9,166.68
June 30, 1903	2,937.27
June 30, 1904	2,916.49
June 30, 1905	3,833.28
Total	167,422.47

Summary of expenditures for operating and care of Galena River improvement for fiscal year ending June 30, 1905.

Month.	Superintendence, office expenses, incidental repairs, and contingencies.	Operating.			Total.
		Labor.	Supplies.	Repairs.	
1904.					
July		$160.00			$160.00
August	$14.72				14.72
September	17.33	160.00		$535.50	712.83
October		160.00		43.50	203.50
November		320.00	$25.80	135.00	480.80
December		160.00		357.00	517.00
1905.					
January	417.71	120.00	7.90	196.50	742.11
February	10.30	160.00	58.70	18.35	242.35
March		120.00	12.00		132.00
May		160.00	56.97		216.97
June		320.00		91.00	411.00
Total	460.06	1,840.00	156.37	1,376.85	3,833.28

COMMERCIAL STATISTICS.

Traffic statement of the Galena River improvement for the fiscal year ending June 30, 1905.

Month.	Boats up and down.	Passengers.	Merchandise.	Lockages.
1904.			*Tons.*	
July	446	3,387	58	331
August	293	1,334	148	212
September	278	1,429	329	214
October	285	704	577	150
November	65	144	206	53
1905.				
March	15	52	96	.....
April	238	377	217	13
May	148	1,397	198	113
June	894	1,804	1,111	.....
Total	2,162	10,628	2,940	1,086

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Y 7.

IMPROVEMENT OF HARBOR AT LA CROSSE, WISCONSIN.

Seven hundred linear feet of shore protection was built on Barrons Island, and some repairs were made to closing Dam 2 (mile 142).

Money statement.

July 1, 1904, balance unexpended	$1,964.35
June 30, 1905, amount expended during fiscal year	1,598.96
July 1, 1905, amount unexpended	365.39

ABSTRACT OF APPROPRIATIONS.

By act approved—	
June 3, 1896 (allotment)	$5,000
March 3, 1899	12,000
Total	17 000

Y 8.

ESTABLISHMENT OF HARBOR LINES IN MISSISSIPPI RIVER AT HANNIBAL, MISSOURI.

CITY OF HANNIBAL.

HANNIBAL, MO., *February 24, 1904.*

SIR: In compliance with the resolution adopted by the city council of the city of Hannibal, Mo., at a regular session held on Thursday, February 18, 1905, and approved by his honor the mayor of said city, a copy of which is transmitted herewith, together with the plat[a] referred to in said resolution, to you, and through you in the proper official channel to the Secretary of War, we respectfully request that you give the purpose of the resolution your personal and official indorsement, so far as you can do so consistently with your official duties.

It is the desire of the people of the city of Hannibal to improve the appearance and utility of their river frontage and seek to do so in compliance with the regulations of the Government which may be applicable to such conditions.

Very respectfully,

[SEAL.] CHAS. F. SHEPHERD,
City Clerk of the City of Hannibal, Mo.

Maj. JAMES L. LUSK,
United States Engineer, Rock Island, Ill.

[a] Not printed.

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[First indorsement.]

U. S. ENGINEER OFFICE,
Rock Island, Ill., February 26, 1904.

Respectfully forwarded to the Chief of Engineers, U. S. Army.

The conditions affecting navigation at Hannibal are such as to make it desirable, from the point of view of the United States, that harbor lines be established—at least between the limits set forth within—and probably beyond those limits.

It is therefore recommended that a special survey be made, and that $300 be allotted for the purpose from the appropriation for "Examinations, Surveys, and Contingencies of Rivers and Harbors," and that after the completion of the survey and resulting map, a public hearing for all interested parties be held.

JAMES L. LUSK,
Major, Corps of Engineers.

[Second indorsement.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, February 29, 1904.

Respectfully returned to Major Lusk, who is authorized to proceed as recommended in first indorsement hereon.

The sum of $300 is hereby allotted for the purpose from the appropriation for "Examinations, Surveys, and Contingencies of Rivers and Harbors."

To be returned.

By command of Brig. Gen. Mackenzie:

H. F. HODGES,
Major, Corps of Engineers.

[Third indrsement.]

U. S. ENGINEER OFFICE,
Rock Island, Ill., April 15, 1905.

Respectfully returned to the Chief of Engineers, inviting attention to report of this office dated April 13, 1905.

In the absence and by direction of Major Riché:

C. W. DURHAM,
Assistant Engineer.

[Sixth indorsement.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, May 8, 1905.

Respectfully submitted to the Secretary of War.

The city council of Hannibal, Mo., requests the establishment of harbor lines on the water front of the Mississippi River at that place.

The matter was presented through the district engineer officer, who reported that the establishment of such lines was also desirable in the interests of navigation.

The lines which it is proposed to adopt have been determined after a preliminary survey and a public hearing, held February 23,

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1905, at which the lines were agreed upon by the various interests involved.

Concurring in the views of the local officers, I recommend that harbor lines be established at Hannibal and that the lines selected, which are delineated on the accompaning tracing[a] and described in a separate paper, be approved by the Secretary of War.

I further recommend that the Secretary indicate his approval on the tracing[a] and description, both of which have been prepared for his signature.

A. MACKENZIE,
Brig. Gen., Chief of Engineers, U. S. Army.

RESOLUTION OF THE CITY OF HANNIBAL, MO.

A resolution by Alderman Plowman.

Be it resolved by the city council of the city of Hannibal, Mo., That the city engineer be, and is hereby, instructed to furnish a suitable tracing of the river front of the city of Hannibal, showing the formation of the bank from the north line of North street south to the mouth of Bear Creek, and that the same be transmitted with an accompanying communication through the proper official channel to the Secretary of War, requesting that Department of the Government to cause the necessary survey to be made for the purpose, and to establish, in accordance with the regulations of the Government in such cases, a wharf or harbor line along the river frontage of the city of Hannibal from the north line of North street to the mouth of Bear Creek.

Adopted February 18, 1904.

Approved February 18, 1904.

[SEAL.] JOHN N. BASKETT, *Mayor.*

Attest:

CHAS. F. SHEPHERD, *City Clerk.*

STATE OF MISSOURI, *County of Marion, City of Hannibal, ss:*

In the office of the city clerk of the city of Hannibal, Mo.

I, Charles F. Shepherd, city clerk of the city of Hannibal, in the county of Marion, State of Missouri, hereby certify that the foregoing words are and constitute a full, true, and complete copy of a resolution passed by the city council of the city of Hannibal, as fully as the same remains on file and of record in my office as said city clerk.

In witness whereof I hereto set my hand, name, and official signature and affix hereto the corporate seal of said city at my office as said city clerk, in the city of Hannibal, Mo., this 23d day of February, A. D. 1904.

[SEAL.] CHAS. F. SHEPHERD,
City Clerk of the City of Hannibal, Mo.

REPORT OF MAJ. C. S. RICHÉ, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Rock Island, Ill., April 13, 1905.

GENERAL: I have the honor to present the following report in regard to the establishing of harbor lines at Hannibal, Mo.:

Maj. Jas. L. Lusk, Corps of Engineers, my predecessor in charge of the Rock Island district, received from Mr. Chas. F. Shepherd, city clerk of Hannibal, Mo., a communication, dated February 24, 1904, requesting the establishment of harbor lines at Hannibal in accordance

[a] Not printed.

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with the regulations of the Government. With Mr. Shepherd's letter was a copy of a resolution of the city council of Hannibal, as follows:

Be it resolved by the city council of the city of Hannibal, Mo., That the city engineer be, and is hereby, instructed to furnish a suitable tracing of the river front of the city of Hannibal, showing the formation of the bank from the north line of North street south to the mouth of Bear Creek, and that the same be transmitted with an accompanying communication through the proper official channel to the Secretary of War, requesting that Department of the Government to cause the necessary survey to be made for the purpose, and to establish, in accordance with the regulations of the Government in such cases, a wharf or harbor line along the river frontage of the city of Hannibal from the north line of North street to the mouth of Bear Creek.

Adopted February 18, 1904.

Approved February 18, 1904.

JOHN N. BASKETT, *Mayor.*

Mr. Shepherd's letter was forwarded to the Chief of Engineers by Major Lusk February 28, 1904, with the following (first) indorsement:

* * * The conditions affecting navigation at Hannibal are such as to make it desirable, from the point of view of the United States, that harbor lines be established—at least between the limits set forth within, and probably beyond those limits.

It is therefore recommended that a special survey be made, and that $300 be allotted for the purpose from the appropriation for "Examinations, Surveys, and Contingencies of Rivers and Harbors," and that after the completion of the survey and resulting map, a public hearing for all interested parties be held.

The Chief of Engineers returned the letter with the following (second) indorsement, dated February 29, 1904:

Respectfully returned to Major Lusk, who is authorized to proceed as recommended in first indorsement hereon.

The sum of $300 is hereby allotted for the purpose from the appropriation for "Examinations, Surveys, and Contingencies of Rivers and Harbors."

A survey of the river and adjoining shores, including the entire river frontage of Hannibal (about 2 miles in length), was made in November, 1904, and detail maps have been plotted, one on a scale of 1 inch to 100 feet, and one on a scale of 1 inch to 400 feet.

Notice of a public meeting to be held at 11 a. m., February 23, 1905, in the county court-house at Hannibal, was published in the Courier Post and the Journal, of Hannibal. Written notices were sent to the mayor of Hannibal, to the superintendent of the Diamond Jo Line of steamers, and to the presidents and chief engineers of the Chicago, Burlington and Quincy, the Wabash, the Missouri, Kansas and Texas, the Missouri Pacific, and the St. Louis and Hannibal railway companies, all of whom are interested parties. The meeting was well attended by representatives of the city, of the railroads and steamboats, and by several private property holders. The maps showing the tentative harbor lines were submitted; discussion was invited and freely indulged in. The proposed harbor lines met the approval of all after some slight changes had been made.

I now have the honor, in accordance with the provisions of section 11 of the river and harbor act of March 3, 1899, to submit, for the action of the Secretary of War, the harbor lines as agreed upon at the public meeting and as laid down in red on the accompanying map, and to recommend their adoption. A copy of the description also accompanies this report.

Very respectfully, your obedient servant,

C. S. RICHÉ,
Major, Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

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DESCRIPTION OF THE HARBOR LINES FOR THE MISSISSIPPI RIVER AT HANNIBAL, MO.

Beginning at a point on the center line of the Wabash Railway bridge crossing the Mississippi River at Hannibal, said point being a copper bolt leaded horizontally in the east face of the west abutment of bridge about 1 foot below top of abutment, and being 245.5 feet from the center of the west draw-rest pier measured along the axis of the bridge, and also being 75.5 feet from precise bench mark No. 16 of the Mississippi River Commission, said bench mark being a bolt in face of natural rock at east entrance of the tunnel at the Missouri end of the bridge, said bolt being 7 feet south of entrance to tunnel and about 4 feet above level of roadway; thence southeasterly in a straight line making an angle of 94° 30′ with the center line of the bridge to a point bearing northeasterly 126.8 feet from United States monument No. 1, said monument being set 86.4 feet from the west line of Bridge street measured at a right angle with said west line from a point 629.9 feet southeasterly from the stone marking the southwest corner of Ridge and Bridge streets, said point, said monument No. 1, and said harbor line point being in the same straight line; thence southeasterly in a straight line to a point in the southeasterly or down-river line of Ferry street, said point being 96.3 feet northeasterly from United States monument No. 2, said monument being set on the southeasterly line of Ferry street and being 106.7 feet from the southwest corner of Ferry and Bridge streets; thence southeasterly in a straight line to a point in the prolongation northeasterly of the southeasterly line of Hill street, said point being 122.2 feet northeasterly from United States monument No. 3, said monument being set on the southeasterly line of Hill street prolonged and being 135.8 feet from the southwest corner of Hill and First streets; thence southeasterly in a straight line to a point in the prolongation northeasterly of the southeasterly line of Broadway, said point being 437.6 feet from United States monument No. 4, said monument being set on the southeasterly line of Broadway prolonged and being 102.4 feet from the northeast corner of the stone foundation of the Empire mill, which foundation corner lies on the southeasterly line of Broadway; thence southeasterly in a straight line, making an angle of 168° 10′ with the harbor line last described, 2,885 feet, to a point 54.7 feet northeasterly from United States monument No. 5, said point and said monument being set on a straight line at a right angle with a straight line (shown in red on map) connecting the point of curve (P. C.) and tangent point (P. T.) of the Chicago, Burlington and Quincy Railway, said P. C. and P. T. being marked by rail monuments set, with cross in tops, vertically in the center of the main track, said monument No. 5 being set 20.3 feet from said straight line, the right angle being turned from a point on said straight line 150.8 feet from the P. T. monument; thence southeasterly in a straight line making an angle of 194° 30′ with the harbor line last described, 3,060 feet to a point in the south city-limits line of the city of Hannibal, said point being 126.2 feet due east of United States monument No. 6, said monument being set on said city-limits line 77.1 feet northeasterly from the northeast corner of stone foundation of dwelling house (shown on map) located on west side of wagon road.

The United States monuments are of granite, 8 inches square on top, about 10 inches square at base, and 30 inches long; the top is dressed square and has a hole three-fourths inch in diameter drilled in center. The center of the drill hole is the point of reference. The letters "U. S." and the number of the monument are cut on top.

The proposed harbor lines are intended to represent both the pierhead and the bulkhead lines.

WAR DEPARTMENT,
Washington, May 11, 1905.

Approved.

ROBERT SHAW OLIVER,
Assistant Secretary of War.

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APPENDIX Z.

RESERVOIRS AT HEADWATERS OF MISSISSIPPI RIVER; IMPROVEMENT OF MISSISSIPPI RIVER FROM ST. PAUL TO MINNEAPOLIS, MINNESOTA; OF RIVERS IN WISCONSIN AND MINNESOTA TRIBUTARY TO THE MISSISSIPPI RIVER; OF WARROAD HARBOR AND RIVER, MINNESOTA, AND OF RED RIVER OF THE NORTH, MINNESOTA AND NORTH DAKOTA.

REPORT OF MAJ. GEO. M'C. DERBY, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1905, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Mississippi River between St. Paul and Minneapolis, Minnesota.
2. Reservoirs at headwaters of Mississippi River, and Mississippi River between Brainerd and Grand Rapids, Minnesota.
3. Operating and care of reservoirs at headwaters of Mississippi River.
4. St. Croix River, Wisconsin and Minnesota.
5. Minnesota River, Minnesota.
6. Red River of the North, Minnesota and North Dakota.
7. Warroad Harbor and Warroad River, Minnesota.
8. Survey of Otter Tail Lake and Otter Tail River, and Red Lake and Red Lake River, Minnesota, and Big Stone Lake and Lake Traverse, Minnesota and South Dakota.
9. Gauging Mississippi River at or near St. Paul, Minnesota.

UNITED STATES ENGINEER OFFICE,
St. Paul, Minn., July 16, 1905.

GENERAL: I have the honor to submit herewith report upon the works of river and harbor improvements in my charge for the fiscal year ending June 30, 1905.

Very respectfully, your obedient servant,

G. McC. DERBY,
Major, Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

Z 1.

IMPROVEMENT OF MISSISSIPPI RIVER BETWEEN ST. PAUL AND MINNEAPOLIS, MINNESOTA.

The approved project will be found in the Report of the Chief of Engineers for 1905, Part 1, page 431.

The expenditures during the past fiscal year were $103,886.37.

The work during the past year has been the completion of Lock and Dam No. 2 and all preliminaries preparatory to excavation for Lock No. 1.

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The year has been marked by unusual and long-continued high waters, which have retarded the work at both locks. At Lock No. 2 the maneuvering machinery for lower lock gate was installed, the middle (last) section of Dam No. 2 built, and the cofferdam removed. On March 30 the bear-trap sluice gates were raised and the river allowed to pass over the dam. Soundings taken in September, 1904, showed a deep scour below the sluices at west end of Dam No. 2 and a scour of less degree above the sluices. Steps were immediately taken to cover with large blocks of stone the bed of the river for 30 feet above the sluices, 150 feet below the sluices, and below the west 66 feet of dam adjoining the sluices, where the entire volume of the river had been flowing during the construction of the middle section of the dam. It was also decided to pave the bed of the river for 30 feet in width, 3 feet thick, below the middle section of the dam before the cofferdams were removed, to protect this portion of the dam from injury by a possible scour below the apron. The riprapping was accomplished late in the fall, during the winter, and in the early spring, using 7,064 cubic yards of stone. Many of the stones weighed 2½ tons each.

On April 4 the river was diverted through the lock, which had been specially designed for such use, to permit the strong current to wash away a bar and other obstructions at the lower entrance to the lock. The lock gate was opened too suddenly, and the lock floor was injured during the process. The necessary repairs have not yet been made because of the high stage of water.

At Lock No. 1 the cofferdam was finished, grade for cableway tracks completed, 60 feet of cableway tracks laid on each bank, and three-fourths of cableway towers built. A large building to contain shops, storeroom, and office was built; also a storage house on east bank of the river. A pumping plant was installed, a steam derrick set up, and tracks laid for conveying to spoil banks the waste material obtained in excavation. The excavation for the lock should have been well advanced by this time, but unusual high water has limited work of that character to ten days only.

Details of work done will be found in the accompanying report of Mr. A. O. Powell, assistant engineer.

Money statement.

July 1, 1904, balance unexpended	$457,039.78
June 30, 1905, amount expended during fiscal year, for works of improvement	103,886.37
July 1, 1905, balance unexpended	353,153.41
July 1, 1905, outstanding liabilities	20,752.63
July 1, 1905, balance available	332,400.78
July 1, 1905, amount covered by uncompleted contracts	2,550.85
Amount (estimated) required for completion of existing project	299,543.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	299,543.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

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ABSTRACT OF APPROPRIATIONS.

August 18, 1894	$51,000.00
July 13, 1892 (allotted by act of August 18, 1894)	49,877.67
June 3, 1896	100,000.00
March 3, 1899	150,000.00
June 6, 1900	185,000.00
March 3, 1901	157,000.00
June 28, 1902	250,000.00
March 3, 1903	223,579.33
Total	1,166,457.00

ABSTRACT OF CONTRACTS (EMERGENCY) IN FORCE.

Name.	Date.	For—	Unit price.	Date of beginning.	Date of expiration.
	1905.			1905.	1905.
The Menz Lumber Co	Feb. 10	432,000 feet B. M. fir lumber.	$7.25 per M. feet	Feb. 20	Apr. 12
E. O. Fellows Coal Co	June 19	7 cars coal	$2.80 per ton	June 29	Oct. 15

COMMERCIAL STATISTICS.

The principal commerce over this part of the river is that of drifting about 124,000,000 feet B. M. of loose logs (about 434,000 tons) over the upper and middle sections and rafting the same with steamboats on the lower section. The estimated value of these logs was $1,250,000.

The excursion business on the lower and middle sections amounted to about $15,000. The river is also much used by numerous steam and naphtha pleasure boats.

REPORT OF MR. A. O. POWELL, ASSISTANT ENGINEER.

ST. PAUL, MINN., *July 12, 1905.*

MAJOR: I have the honor to submit a report of operations upon the improvement of the Mississippi River between Minneapolis and St. Paul during the fiscal year ending June 30, 1905.

CONDITIONS AT BEGINNING OF THE YEAR.

LOCK AND DAM NO. 2.

The construction scheme for No. 2 divided the site into three sections. The east section comprised the lock only; the west section included the two bear-trap sluices, each 50 feet wide, and 90 feet of the roll dam; and the middle or last section built consisted of 431 feet of the roll dam.

By June 30, 1904, the east and west sections were completed, except the removal of lock cofferdam, installation of maneuvering machinery for lower lock gate, and the building of 7 feet in depth of cribwork on 90 feet of dam inclosed in the west section, which was purposely omitted to provide additional escape for water while the middle section was in process of construction. The closing cofferdams for middle section were built, inclosure pumped out, and everything in readiness for a vigorous prosecution of the work.

LOCK AND DAM NO. 1.

Roads to the east and west approaches to the lock and dam had been built, grades for cableway tracks were nearly finished, the lock cofferdams almost completed, and a few buildings erected.

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CONDITIONS AT END OF THE YEAR.

LOCK AND DAM NO. 2.

The lock and dam are completed with the exception of about two weeks' work to complete riprapping above and below sluices at west end of dam and repairs to the lock floor.

LOCK AND DAM NO. 1.

All roads and approaches to both ends of the lock and dam are built; all grading finished for cableway tracks, 60 feet of track on each bank laid, ties collected and distributed for balance of track, and both towers about three-fourths completed; the lock cofferdam completed, and all buildings erected.

OPERATIONS DURING THE PAST FISCAL YEAR.

The stage of water that has prevailed almost continuously during the open season for the past twelve months has been unusually high and seriously interfered with construction work, both in delay and increased cost.

LOCK NO. 2.

Maneuvering machinery for lower lock gate was installed and tested. The operating power for the present will be by hand, but provision is made for attaching any form of motor that the future needs of commerce may require. So much of the lock cofferdam was removed as was necessary to provide for navigation. It was expected to open the lock for navigation in April, but it was first necessary to remove a shoal and the remains of the cofferdam that partially blocked the entrance to the lower end of the lock. A dredge was not available for the work, and on April 4 an attempt was made to scour the bar by opening the lock to the passage of water. The obstruction was removed sufficiently to enable steamers to enter the chamber, but the lock floor was injured to such an extent that it is necessary to repair the floor before boats can be locked through. The high stage of water has prevented repairs being made up to this time.

DAM NO. 2.

The middle section of the dam was built as well as the crib superstructure on the 90 feet of dam built the previous year. The construction of the cut-off wall was a slow and tedious process; many difficulties were encountered but overcome, and the wall was put down to the predetermined depth except sections 5 and 6, covering a space of 26 feet, 83 feet west of the chamber face of the river wall of the lock. At this point the sand rock was deep and soft. The sections were jetted to the required depth, but could not be cleaned to the full depth because of the caving of the sides and washing in of gravel. The first efforts at cleaning were carried to within 5 feet of grade; the sections were then grouted in hopes that the grout would so far strengthen the sides of the cuts that they could be safely reopened down to grade. After the grouting was done, three subsections of 4 feet each (one at east end of No. 5, one between No. 5 and No. 6, and one at west end of No. 6) were drilled out. The cleaning was carried down to within 2 feet 9 inches of grade, beyond which no progress was made. The time before the spring freshet was growing so short that no further efforts were made to grout sections 5 and 6 down to grade. The space between grout and grade lines is closely packed with gravel and pulverized sand rock, which in itself makes a fair wall. As an additional precaution, holes were drilled down through the grout and some loose material below the grout was pumped out, after which grout made from 50 bags of cement was injected into the holes. It is believed that this portion of the cut-off wall is perfectly safe.

The grouted portion of the cut-off wall is from 4 inches to 6 inches or more wide, and extends on an average 10 feet into the sand rock to a depth of 23 feet 3 inches below natural ordinary low water. For the middle section of the dam the cut-off wall above the tops of the grouted sections was made of concrete 4 feet thick and tightly joined to the upstream slope of the dam at an elevation of 4 feet 6 inches above natural ordinary low water. For the 90 feet of dam built the previous year, the concrete extension was only from 2 to 4 feet high. Above that elevation reliance was placed on the timber core made of two thicknesses of 2-inch plank, backed by earth and gravel.

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In excavating for the apron crib middle section of dam a weak spot in the sand rock was uncovered. The exposed water-bearing seam showed the rock to be so soft and the volume of water discharged so large that it was deemed dangerous to wholly uncover the seam, and for this portion the excavation was carried down to only 9 feet 11 inches below ordinary low water, instead of 13 feet 3 inches, as in the case of the remainder of the apron. The depth of the crib apron was maintained at 8 feet, but where it crossed the bad spot it was raised 40 inches, which still leaves it 20 inches below ordinary low water. The length of the high portion of the apron is 199 feet, and its center is 338 feet 4 inches west from the chamber face of the river wall of the lock.

In September a deep scour was discovered below the sluices at west end of dam. The maximum scour was 25 feet below ordinary low water. Preparations were made at once to heavily riprap the bed of the river over the scoured area, and also to riprap the bed of the river above the sluices where a scour of less degree had been detected. Fortunately an excellent limestone quarry was available on adjacent land owned by the United States. The quarry was stripped and a steam derrick installed, tracks were laid from the quarry to the lock, and from here the stone was handled by the cableway and dumped over the scoured area. Some of the blocks of stone weighed 2½ tons. The river bed for a distance of 30 feet below the apron of middle section of dam was paved with like stone to a depth of 3 feet. Up to date 8,655⅔ cubic yards of stone have been quarried, at a cost of $1.60 per cubic yard for preparation, quarrying, and distribution, as follows:

	Cubic yards.
Below apron of middle section of dam	1,426
Below the 90 feet of dam built the previous year	795
Below sluices	4,515
Above middle section of dam	111
Above the 90 feet of dam built the previous year	363
Above sluices	328½
In crib superstructure of dam	759½
For concrete in cut-off wall	116⅔
Stored for emergency	41

Most of the quarrying and distribution of stone was done in the winter time. The riprapping of the bed of the river above and below sluices would have been completed early in the season had there not been continuous high water. It will probably take two weeks, with a favorable stage of the river, to finish. The dam was completed March 30, the bear-trap gates were closed the same day, and the water turned over the dam. Last month the river reached the highest stage during the past eight years. So far as is now apparent the dam has not suffered.

LOCK NO. 1.

Completed cofferdam filling. Completed grades for cableway tracks and laid 90 feet of track on each bank of the river. Completed three-fourths of the cableway towers. A storage shed was built on the west side. Erected a building 35 by 125 feet for blacksmith shop, carpenter shop, storehouse, and office. The south 40 feet of the building is two stories high. The bluffs at the site of the lock were so precipitous that a site for the building had to be excavated; for the same reason we were also forced to excavate for coal bins. An engine and boiler shelter for pumping the lock was built and all preparations were made for pumping the lock cofferdam inclosure early in April; also to commence excavation for the lock. Unfortunately the river has been at such a high stage that the excavation has been barely commenced, only 732 cubic yards having been removed. Three attempts were made to pump out the lock, but each time a rise in the river forced a suspension. Prospects are not bright for the commencement of work until late in the fall. The little excavation done showed that the soil overlying the precipitous part of the sand-rock portion of the bluff would cave in as excavation progressed, and it became evident that the tracks for removing the material would have to be built on a solid foundation. The time lost by high water has been partly utilized by excavating into the side of the bluff to a solid foundation for the material tracks. Most of this work, however, might as well have been carried on while excavation was in progress.

A large quantity of lumber has been purchased, received, sorted, and piled, and a quantity of surplus material from Lock and Dam No. 2 was hauled down to No. 1.

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EXPENDITURES.

The cash expenditures have been itemized in the following table:

Statement of expenditures from commencement of work to June 30, 1905.

LOCK AND DAM NO. 2.

Miscellaneous:	
Lands, surveys, borings, water supply, etc	$30,934.17
Roads, ditches, and sidetracks	5,041.43
Lock tender's house	300.58
Carpenter and blacksmith shop	1,588.68
Cement warehouse	954.77
Stone and sand bins	2,476.52
Clearing Government land	856.70
Booms	605.26
Cleaning up	348.03
Removing buildings and tube mill	409.65
	43,515.79
Plant:	
Cableway	17,899.93
Air compressor	18,894.88
Pumping outfit	4,436.60
Crushing outfit	2,776.80
Mixing outfit	1,360.46
Tube mill	5,000.00
Pile-driver barges	2,235.53
Tracks and cars	4,494.43
Tools	5,169.45
	62,268.08
Lock No. 2:	
Cofferdam	21,440.46
Stopping leaks	7,303.43
Pumping	20,510.02
Excavation	17,527.49
Cut-off walls	8,009.03
Timber and iron	35,406.41
Cement	36,832.67
Silica cement (exclusive of cost of materials)	7,776.95
Stone, granite	18,148.37
Breaking stone	4,603.41
Crushing stone	9,978.70
Crushed sandstone	4,864.82
Sand	7,556.47
Mixing and placing concrete	23,703.05
Concrete forms	15,595.63
Removing concrete	422.34
Grouting foundation, upper lock gate	2,997.85
Permanent subdrainage	4,115.68
Repairs, lock floor	360.84
Snubbing posts	200.00
Filling back of land wall	6,198.93
Upper lock gate	14,470.04
Lower lock gate	20,368.59
Filling valves	1,511.70
Permanent coffers	1,352.72
Guide piers	3,003.78
Dredging	82.71
	294,342.09

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Dam No. 2:	
Cofferdam	$25,177.97
Upper closing cofferdam	10,435.46
Pumping	26,107.09
Excavation	22,064.13
Leaks	1,022.13
Cut-off walls	16,901.39
Round piles	6,857.11
Sheet piles	1,760.99
Timber and iron	50,692.00
Cement	19,190.62
Silica cement (exclusive of materials)	1,927.30
Stone	8,303.75
Breaking stone	900.56
Crushing stone	3,482.80
Sand	708.58
Mixing and placing concrete	10,357.86
Concrete forms	5,126.30
Sluice gates	24,341.88
Filling dam and behind land wall	6,814.51
Protection against high water during construction	6,232.46
Riprapping below apron, middle section	2,459.20
Riprapping above and below sluices and 90 feet of dam	10,409.32
	261,273.41

LOCK AND DAM NO. 1.

Miscellaneous:	
Lands, surveys, borings, water supply, etc	$15,431.18
Roads, ditches, etc	10,856.38
Buildings	7,939.66
Clearing Government land	1,144.87
	35,372.09
Plant:	
Barges and pile drivers	718.81
Cableway	4,808.95
Moving plant	1,450.97
Tracks, etc	111.64
Tools	148.43
	7,238.80
Lock No. 1:	
Cofferdam	17,238.04
Excavation	1,911.19
Timber and iron	22,651.62
Pumping	929.54
Round piles	355.23
	43,085.62
Dam No. 1:	
Cofferdams	2,481.44

SUPERINTENDENCE AND CONTINGENCIES.

St. Paul office	$43,964.37
Office Chief of Engineers	480.00
Office Division Engineer	462.50
Inspection	7,636.23

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Watching	$9,262.25
Care of dredge	533.74
Models for Louisiana Purchase Exposition	1,387.18
	63,726.27
Total expenditures	813,303.59

Respectfully submitted.

A. O. POWELL,
Assistant Engineer.

Maj. GEO. McC. DERBY,
Corps of Engineers.

Z 2.

CONSTRUCTION OF RESERVOIRS AT HEADWATERS OF MISSISSIPPI RIVER AND IMPROVEMENT OF MISSISSIPPI RIVER BETWEEN BRAINERD AND GRAND RAPIDS, MINNESOTA.

The approved project and report of progress of the work up to June 30, 1904, will be found in the Report of the Chief of Engineers for 1905, Part 1, page 432.

The expenditures during the fiscal year were $22,381.52.

During the year the reconstruction of Pokegama Falls dam was completed, the plant dismantled and removed to Pine River dam where the preliminary work of reconstruction was begun. The maps of reservoir survey were completed, as were also the lists of lands affected by reservoir flowage. Negotiations for the purchase of lands affected by flowage, or easements thereon, were commenced. Agreements were reached and the flowage rights or the titles to the land have been secured on 283 tracts, aggregating 5,735.26 acres.

The removal of snags and other obstructions in the channel and overhanging trees and brush along the banks of the Mississippi River between Brainerd and Grand Rapids, Minn., was continued until October 24, 1904, when the plant was laid up owing to shortness of funds. In May, 1905, necessary repairs to the plant were made, and work on the river was resumed about the middle of June.

Details of work done will be found in the appended report of Mr. Thomas Robinson, assistant engineer.

Of the total expenditure during the year there was for—

Pokegama Falls dam reconstruction	$2,981.30
Pine River dam reconstruction	6,211.16
Surveys and mapping	278.69
Listing flowage lands, preparation of abstracts of title, and purchase of lands or easements	6,864.60
Improving Mississippi River between Brainerd and Grand Rapids, Minn.	3,597.67
Office expenses	2,448.10

It is expected to complete the reconstruction of Pine River dam and resume work on the dikes of Pine River reservoir during the year; to continue the removal of obstructions on the Mississippi River between Brainerd and Grand Rapids, and continue the efforts to acquire lands, or easements thereon, affected by flowage from the reservoirs.

On completion of the renewal of Pine River dam and the construction of dikes at Pine River reservoir, provision should be made for the

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renewal of Sandy Lake dam. The structure is in fair condition now, but the timbers are rapidly decaying. It is estimated that it will cost $125,000 to rebuild it with a lock for steamboats as at present, or $75,000 without the lock.

Provision should also be made for continuation of the work of improving the Mississippi River between Brainerd and Grand Rapids, Minn. The adjacent territory is rapidly settling up, and the railroad facilities are quite inadequate, so that steamboat traffic should increase if the river is kept in order.

Total expenditure from appropriation for construction of reservoirs since July 1, 1898, when the cadastral surveys and the renewal of the old dams were begun.

Contingencies:		
Main office	$23,537.79	
Inspection	1,999.39	
Road between Lake Winnibigoshish and Leech Lake dams	684.53	
Examination of Long Prairie River	32.42	
Examination of Willow River	52.83	
		$26,306.96
Surveys:		
Plant	4,265.82	
Pine River reservoir	2,910.67	
Pokegama Falls reservoir	9,452.38	
Leech Lake reservoir	27,873.10	
Lake Winnibigoshish reservoir	33,307.15	
Sandy Lake reservoir	6,223.34	
At Aitkin	877.94	
Below Pokegama	714.97	
		85,625.37
Lands, easements, etc.:		
Below Pokegama	4,244.44	
Above Pokegama	13,395.46	
		17,639.90
Pine River reservoir:		
Dikes 1, 3, 4, and 14	9,070.24	
Damage caused by crevasse June 17, 1896	1,733.00	
		10,803.24
Pokegama Falls reservoir, booms		1,526.83
Reconstruction of Lake Winnibigoshish dam:		
Minor buildings	3,074.53	
Plant	9,198.39	
Cofferdam	16,301.40	
Embankments	10,380.42	
Repairs to old foundations	23,213.29	
Concrete	47,701.70	
Cement house	2,311.22	
Log sluice gate	11,366.75	
Tainter gates	15,751.53	
Piers and booms above dam and embankment	5,029.41	
		144,328.64
Reconstruction of Leech Lake dam:		
Repairs to buildings	1,333.50	
Miscellaneous	3,148.00	
Plant	7,362.08	
Cofferdams	13,080.19	
Removal of old dam	2,013.05	
Repairs to old foundations	14,605.98	
Concrete	21,655.54	
Stop plank and hoisting gear	2,352.75	
Embankments	4,003.40	
Bridge over dam	573.38	
		70,127.87

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Reconstruction of Pokegama Falls dam:		
Excavation	$1,707.54	
Embankments	1,729.00	
Cofferdam	10,820.65	
Steel work, gates, etc	26,545.45	
Plant	5,626.69	
Concrete	33,744.83	
Removal of old dam	7,173.30	
Repairs and alterations to buildings	3,959.14	
Repairs to old foundations	851.33	
Fishway	85.58	
Miscellaneous	2,048.60	
Bridge over dam	295.20	
		$94,587.31
Reconstruction of Pine River dam:		
Abutments	30.00	
Cofferdam	664.33	
Concrete	801.21	
Plant	986.31	
Removal of old dam	1,393.48	
Repairs to old foundations	354.03	
Repairs to buildings	925.46	
Shelter sheds	14.16	
		5,168.98
Telephone line between Pequot, Minn., and Pine River dam		1,042.18
Improving Mississippi River between Brainerd and Grand Rapids:		
Plant	938.13	
Removal of obstructions	8,305.84	
Inspection	173.59	
		9,417.56
Total		466,574.84

Estimate for the work contemplated in the approved project.

Completion of renewal of Pine River dam	$70,000
Renewal of Sandy Lake dam	125,000
Construction of dikes, Pine River reservoir	25,000
Purchase of lands or easements	75,000
Improving Mississippi River between Brainerd and Grand Rapids, Minn. (two years)	20,000
Contingencies	40,000
	355,000
Balance unexpended July 1, 1905	215,000
Amount required	140,000

Money statement.

July 1, 1904, balance unexpended	$80,078.55
Amount appropriated by river and harbor act approved March 3, 1905	160,000.00
Miscellaneous receipts	34.00
	240,112.55
June 30, 1905, amount expended during fiscal year, for works of improvement	22,381.52
July 1, 1905, balance unexpended	217,731.03
July 1, 1905, outstanding liabilities	4,262.70
July 1, 1905, balance available	213,468.33

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July 1, 1905, amount covered by uncompleted contracts (estimated)	$1,000.00
Amount (estimated) required for completion of existing project	140,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	125,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

ABSTRACT OF APPROPRIATIONS.

By act—		By act—	
Approved June 14, 1880	$75,000	Of August 18, 1894	$51,000
Approved March 3, 1881	150,000	Passed June 3, 1896	80,000
Passed August 2, 1882	300,000	Approved March 3, 1899	210,000
Approved July 5, 1884	60,000	Approved June 13, 1902	250,000
Approved August 5, 1886	37,500	Approved March 3, 1905	160,000
Of August 11, 1888	12,000	Miscellaneous receipts	34
Approved September 19, 1890	80,000	Total	1,525,534
Approved July 13, 1892	60,000		

ABSTRACT OF CONTRACT (EMERGENCY) IN FORCE.

Name.	Date.	For—	In effect.	Expires.
Geo. M. Kidd	Apr. 24, 1905	Hauling 500 tons freight	Apr. 26	Nov. 30, 1905

COMMERCIAL STATISTICS.

[Mississippi River between Brainerd and Grand Rapids.]

Steamer *Irene* made regular trips during the season of 1904 between Grand Rapids and Aitkin, with an occasional trip to Brainerd. It carried about 2,000 tons general merchandise, valued at $101,000, and about 1,300 passengers between local points.

About 491,000,000 feet B. M. of logs were floated down the river. The weight of these logs was about 1,715,000 tons, and their value about $4,500,000.

In addition to loose logs, rafts of logs, railroad ties, cedar poles, and posts were floated down, but the actual quantities could not be obtained.

REPORT OF MR. THOMAS ROBINSON, ASSISTANT ENGINEER.

CROSSLAKE, MINN., *June 30, 1905.*

MAJOR: I have the honor to submit report on reconstruction of reservoirs at the headwaters of the Mississippi River and the improvement of that river between Brainerd and Grand Rapids, Minn., for the fiscal year ending June 30, 1905.

RECONSTRUCTION OF POKEGAMA FALLS DAM.

At the opening of the year the work was nearly completed. During the months of July and August the stop-plank hoist and carrier was received and erected, all the steel work of the dam was painted, the grounds were cleared of débris and plant was put in order for storing, the crew was laid off and the structure turned over to the care of the dam tender.

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Later, under authority of the Secretary of War, a wagon-road bridge, 8 feet wide between wheel guards, was constructed. The bridge, a simple structure, built of second-hand lumber and painted, was laid on the tops of the piers on the downstream side of the Tainter gates. The dam and appurtenances are all in good order with the exception of the tender's quarters, which need renewal.

RECONSTRUCTION OF PINE RIVER DAM.

As soon as funds were available plans were prepared and a force was started early in April to make ready for work in the field. Old buildings, standing since the first dam was built, were cheaply repaired, tents were set up for the accommodation of the force, and machines and materials were transferred from Lake Winnibigoshish, Leech Lake, and Pokegama Falls dams.

A cofferdam for a 10-foot head (on the upstream side only) was constructed by erecting a bulkhead across the upper ends of the old sluice intakes and filling the recesses between it and the old gates with sand. The removal of the old structure was begun, the stone-crushing plant was erected and set to work, and a telephone line from Pequot to the dam, a distance of about 14 miles, was constructed.

Condition of the work.—At the close of the year the rock ballast had been removed from the body of the dam to within 11 feet of the floor, and about one-third of the crib timbers had been taken off to the same level.

IMPROVING MISSISSIPPI RIVER BETWEEN BRAINERD AND GRAND RAPIDS, MINN.

The project for this improvement contemplates the removal of overhanging trees from the banks, and snags, logs, stumps, etc., from the channel. The work previous to June 30, 1904, had secured a fair channel from Grand Rapids to Sandy Lake. During July and the months following, the work was continued down river as far as Aitkin, where, at the close of October, the work was suspended, and the boats were taken back to Sandy Lake and laid up for the winter. On May 13, 1905, operations were resumed. The boats were taken to Grand Rapids for repairs and then set to work on the river channel, where they were employed at the close of the year.

Work done.—In the work thus outlined 80 miles of river were worked over, and 3,110 overhanging trees, 791 bushes, 280 stumps, 825 snags, and 14,503 logs were removed.

Condition of improvement.—There is, in general, a fair channel between Aitkin and Grand Rapids; but during the high water of the present season many small landslides occurred, and resulting snags and overhanging trees require removal. In places the river bed is wide, and some works of contraction are needed. At three points the stream has made partial cut-offs, and these make navigation difficult.

Channel needed.—The boats at present on the river draw 3 feet with full load; many of the drifted logs require 2½ feet and more, and so a channel at least 3 feet in depth should be sought.

Commercial statistics.—The steamer *Irene* made regular trips during the open season between Aitkin and Grand Rapids, with an occasional trip downstream as far as the bridge near Deerwood. During the year the boat carried about 2,000 tons of merchandise, valued at $101,000, and 1,300 passengers. Another boat has been built for this part of the river, but no returns have been received concerning its business. In addition to what the boats carried, quantities of timber have been received at Aitkin for the manufacture of barrel staves, hoops, and head linings, and railway ties, cedar posts, and poles were taken from the river for loading on the railway.

Besides this the following approximate quantities of timber have been drifted down the river during the year:

	Feet B. M.
Logs passed Pokegama Falls dam	91,000,000
Logs from Prairie River	118,000,000
Logs from Swan River Landing and drives	113,000,000
Logs from Willow River	46,000,000
Logs from Sandy Lake, etc	6,000,000
Logs from Pine River, Crow Wing River, Rice River, and Little Willow River	100,000,000
Logs from various landings along river	17,000,000
Total	491,000,000

Probabilities of river business.—Until the timber is all cut from the Indian reservation, the lumber interests upon the stream will continue to be as large as at present, and agricultural business will grow as the timber trade decreases.

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Estimate of cost.—To complete the work between Brainerd and Grand Rapids, in accordance with present project, and to do necessary work at the several cut-offs and shoals, I estimate that $10,000 will be required in addition to the available funds, and to maintain the work an annual outlay of $3,000 will be needed to keep the channel free from obstructions.

Respectfully submitted.

THOMAS ROBINSON,
Assistant Engineer.

Maj. GEO. MCC. DERBY,
Corps of Engineers.

Z 3.

OPERATING AND CARE OF RESERVOIRS AT HEADWATERS OF MISSISSIPPI RIVER.

The approved project and report of progress of the work up to June 30, 1904, will be found in the Report of the Chief of Engineers for 1905, Part 1, page 434.

Lake Winnibigoshish, Leech Lake, Pokegama Falls, and Sandy Lake reservoirs were in operation during the entire year. Pine River reservoir was also operated until April, 1905, when it was put out of use pending the rebuilding of the dam.

It is endeavored to operate the reservoirs to the best advantage for the general welfare. Daily reports are received from each of them and from gauge stations along the river, and the orders to the dam tenders are changed from day to day to best meet the requirements of the situation. The reservoirs affect seven different interests which often conflict: Steamboat navigation below St. Paul, steamboat navigation above St. Paul, logging, mills at Minneapolis, mills above Minneapolis, riparian owners on the river, and riparian owners on the reservoirs. It is impossible to so manage the reservoirs as to suit all concerned, because each party minimizes or ignores entirely the interests of all the others. The reservoirs are being so managed as to benefit, in the course of the year, every one of the seven interests concerned except the riparian owners on the reservoirs, who have been, or are being, compensated in cash. Each of these interests is materially better off than it would be if the reservoirs did not exist, but none are entirely satisfied, and some very much dissatisfied, because each would like the reservoirs managed exclusively for its own benefit, so that it might receive, if possible, all of the great public good which the reservoir system is intended to accomplish and does accomplish.

Without the reservoirs the discharge of the river at St. Paul is liable to fall to 1,700 cubic feet per second, as it has in the past, while with them the discharge can be readily held throughout the navigation season at or above 6,000 cubic feet per second. The benefit to steamboat navigation at and below St. Paul is manifest from these figures.

This same increment to the low-water discharge produces a still greater effect above St. Paul throughout the 424 miles of navigable river between Minneapolis and Cass Lake. It is true that there are but few steamboats on the river above St. Paul at present, but it is mainly due to the fact that the logging industry is using this length of the river to its extreme capacity, making other forms of navigation impossible in many places. There are annually carried about 480,000,000 feet B. M. of logs, or 1,750,000 tons, a very heavy tonnage for so small a stream, largely due to the facilities offered by the reservoir

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system. The use of the reservoirs for the benefit of navigation also benefits the mills, though of course the benefit is not as great for any one mill as it would be if the reservoirs were used as mill ponds to equalize the available power for that mill.

During the year necessary repairs of a minor nature were made to the various dam tenders' quarters and to the telephone lines between Lake Winnibigoshish and Leech Lake dams and Bena, Minn., and between Sandy Lake dam and McGregor, Minn.

The following table shows the discharge and difference in storage for the year:

Reservoir.	Average discharge per second.	Gauge in lake, June 30, 1905.	Quantity in storage at end of year.	Increase (+) or decrease (—) in storage.
	Cubic feet.		*Cubic feet.*	*Cubic feet.*
Lake Winnibigoshish	238	14.08	44,405,000,000	+15,043,320,000
Leech Lake	553	3.38	18,473,252,000	+ 3,387,152,000
Pokegama Falls	784	12.43	5,801,800,000	+ 3,967,800,000
Pine River	400	11.10	3,180,490,000	— 1,168,789,000
Sandy Lake	149	12.19	3,729,570,000	+ 2,608,834,000
Total			75,590,112,000	+23,858,317,000

Attention is invited to the report of Mr. Thomas Robinson, assistant engineer.

Expenditures, exclusive of outstanding liabilities, to June 30, 1905 .... $194,018.51
Amount expended during fiscal year ending June 30, 1905, exclusive of outstanding liabilities 12,855.57

Distribution of liabilities incurred during fiscal years 1898–1905.

	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.
Pokegama Falls dam:								
Operating	$1,697.42	$1,704.08	$1,804.23	$1,704.85	$1,640.28	$887.79	$320.82	$1,198.80
Repairs	144.62	.....	337.45	.....	.....	.....	.....	27.50
Land condemnation	207.40	.....	.....	.....	.....	.....	.....	.....
New gauging station	.....	.....	.....	.....	.....	.....	736.01	213.34
Total	2,049.44	1,704.08	2,141.68	1,704.85	1,640.28	887.79	1,056.83	1,439.64
Leech Lake dam:								
Operating	1,251.02	1,154.45	1,364.11	875.20	1,275.68	909.65	1,443.34	1,154.49
Repairs	163.95	.....	.....	.....	9.45	.....	35.56	3.87
Buildings	.....	.....	.....	.....	.....	3,000.00	212.89	.....
Total	1,414.97	1,154.45	1,364.11	875.20	1,285.13	3,909.65	1,691.79	1,158.36
Lake Winnibigoshish dam:								
Operating	1,734.67	966.10	435.72	722.42	803.33	1,622.25	1,687.69	1,517.84
Repairs	158.41	.....	[a]5,384.12	[b]3,517.70	[c]2,088.31	.....	[d]443.43	[d]150.64
Buildings and grounds	.....	.....	.....	1,587.37	640.74	.....	59.54	.....
Total	1,893.08	966.10	5,819.84	5,827.49	3,532.38	1,622.25	2,190.66	1,668.48
Pine River dam:								
Operating	1,770.41	1,235.28	1,252.00	1,269.75	1,164.92	930.00	960.00	842.89
Repairs	368.05	188.99	.....	.....	.....	.....	6.85	46.36
Crevasse	1,329.72	.....	.....	.....	.....	.....	.....	.....
Total	3,468.18	1,424.27	1,252.00	1,269.75	1,164.92	930.00	966.85	889.25

[a] Repairing dike.
[b] Repairing dike, $8,117.70.
[c] Repairing dike, $1,078.57.
[d] Bank protection below log sluice.

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Distribution of liabilities incurred during fiscal years 1898–1905—Continued.

	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.
Sandy Lake dam:								
Operating	$2,480.44	$1,745.91	$1,581.02	$1,535.44	$1,634.12	$1,408.78	$1,380.25	$1,242.63
Repairs	671.92	[a] 999.15	.....	.....	307.27	.....	5.37	45.12
Total	3,102.36	2,745.06	1,581.02	1,535.44	1,941.39	1,408.78	1,385.62	1,287.75
Superintendence, contingencies, and St. Paul office	3,184.17	1,747.75	3,348.40	3,514.62	3,458.25	2,519.66	3,268.97	4,463.53
Operating steamboat General Poe	1,692.22	.....	.....	.....	.....	.....	.....	.....
Hydrological expenses	1,109.99	[b] 100.00	[b] 120.00	.....	.....	.....	.....	.....
Operating expenses applicable to all reservoirs	1,166.38	2,589.15	1,069.99	2,187.04	1,477.65	1,024.05	719.28	1,891.02
Road between Leech Lake and Lake Winnibigoshish	407.01	1,719.16	2,652.96	1,583.73	.....	.....	.....	.....
Grand total	19,487.80	14,100.02	19,350.00	18,498.12	14,500.00	12,302.18	11,280.00	12,940.00

[a] Telephone line.

[b] Gage readings at Deer River.

Summary of expenditures during the fiscal year ending June 30, 1905.

Services	$7,680.33
Supplies	51.33
Materials	588.25
Traveling expenses	528.08
Office expenses and contingencies	4,007.58
Total	12,855.57

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Relation of run-off to rainfall on the watershed of the Mississippi River above Pokegama Falls Reservoir dam.

[Area of watershed=3,265 square miles. Area of watershed, less lake areas=2,681 square miles. Years 1885 to 1904, inclusive.]

Year.	Rainfall.					Total rainfall (million cubic feet).				Run-off (million cubic feet).				Proportion of run-off to rainfall.				Average volume of run-off per second per square mile.			
						By calendar years.		Since Jan. 1, 1885.		By calendar years.			Since Jan. 1, 1885.	By calendar years.		Since Jan. 1, 1885.		By calendar years.		Since Jan. 1, 1885.	
	At Pokegama Falls Reservoir dam.	At Lake Winnibigoshish Reservoir dam.	At Leech Lake Reservoir dam.	Mean assumed for entire watershed.	Total of assumed mean since Jan. 1, 1885.	Over entire watershed.	Over entire watershed, less lake areas.	Over entire watershed.	Over entire watershed, less lake areas.	Water released from the distributing reservoir at Pokegama Falls.	Water held in reservoirs Dec. 31, in excess (+) of that contained on the preceding 1st of January.	Total run-off.	Total.	For entire watershed.	For entire watershed, less lake areas.	For entire watershed.	For entire watershed, less lake areas.	For entire watershed.	For entire watershed, less lake areas.	For entire watershed.	For entire watershed, less lake areas.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*									*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*
1885..	23.66	28.57	22.74	24.990	24.990	189,555	155,650	189,555	155,650	36,988	+10,460	47,448	47,448	25.0	30.5	25.0	30.5	0.46	0.56	0.46	0.56
1886..	25.94	26.80	22.94	25.226	50.216	191,351	157,124	380,906	312,774	38,840	−11,735	27,105	74,553	14.2	17.3	19.6	23.8	.26	.32	.36	.44
1887..	27.45	24.70	24.69	25.613	75.830	194,283	159,533	575,189	472,307	27,522	− 4,907	22,615	97,168	11.6	14.2	16.9	20.6	.22	.27	.31	.38
1888..	27.14	27.79	29.14	28.023	103.853	212,564	174,543	787,753	646,850	44,776	+18,372	63,148	163,116	29.7	36.2	20.4	24.8	.61	.74	.39	.47
1889..	25.65	21.35	21.59	22.863	126.717	173,424	142,405	961,177	789,255	34,363	−22,109	12,254	172,570	7.1	8.6	17.9	21.9	.12	.14	.34	.41
1890..	26.63	24.29	26.03	25.650	152.367	194,562	159,761	1,155,789	949,016	22,892	+ 8,311	26,203	198,773	13.5	16.4	17.2	20.9	.25	.31	.32	.39
1891..	25.02	25.38	24.18	24.860	177.227	188,569	154,840	1,344,308	1,103,856	22,321	+ 1,651	23,972	222,745	12.7	15.5	16.6	20.2	.23	.28	.31	.38
1892..	20.19	20.98	22.83	21.333	198.560	161,819	132,875	1,506,127	1,236,731	25,028	+ 8,659	33,687	256,432	20.8	25.4	17.0	20.7	.33	.40	.31	.38
1893..	26.24	25.91	24.11	25.420	223.980	192,817	158,328	1,698,944	1,395,059	29,920	+ 2,559	27,361	283,793	14.2	17.3	16.7	20.3	.27	.32	.31	.37
1894..	32.01	23.46	24.41	26.626	250.606	201,970	165,844	1,900,914	1,560,903	30,126	− 2,609	27,517	311,310	13.6	16.6	16.4	19.9	.27	.33	.30	.37
1895..	26.53	25.94	22.86	25.110	275.717	190,466	156,398	2,091,380	1,717,301	27,880	− 6,641	21,239	332,549	11.1	13.6	15.9	19.4	.21	.25	.29	.36
1896..	32.78	32.85	33.27	32.966	308.683	250,060	205,338	2,341,440	1,922,634	30,960	+26,300	57,260	389,809	22.9	27.9	16.6	20.3	.55	.68	.32	.38
1897..	28.24	27.47	25.44	27.050	335.733	205,181	168,481	2,546,621	2,091,115	48,508	+ 7,485	55,993	445,802	27.3	33.2	17.5	21.3	.64	.66	.33	.41
1898..	27.55	24.61	27.08	26.413	362.147	200,352	164,515	2,746,973	2,255,630	68,848	−29,945	38,403	484,205	19.2	23.3	17.6	21.5	.37	.45	.34	.41
1899..	37.29	39.88	32.43	36.533	398.680	277,114	227,548	3,024,087	2,483,178	76,226	− 2,980	73,246	557,451	26.4	32.2	18.4	22.4	.71	.87	.36	.44
1900..	29.35	35.77	23.43	29,516	428.197	223,891	183,845	3,247,978	2,667,023	44,837	+24,335	69,172	626,623	30.9	37.6	19.3	23.5	.67	.82	.38	.46
1901..	29.64	26.04	29.70	28.460	456.657	215,876	177,263	3,463,854	2,844,286	79,544	−10,350	69,194	695,817	32.1	39.0	20.1	24.5	.67	.82	.40	.48
1902..	26.96	24.18	28.23	26.456	483.113	200,680	164,785	3,664,534	3,009,071	58,527	− 7,095	51,432	747,249	25.6	31.2	20.4	24.8	.50	.61	.40	.49
1903..	29.71	25.80	25.25	26.920	510.033	204,195	167,671	3,868,729	3,176,742	39,443	+21,059	60,502	807,751	29.6	36.1	20.9	25.4	.59	.72	.41	.50
1904..	22.66	22.78	22.94	22.793	532.827	172,898	141,968	4,041,622	3,318,710	29,144	+ 6,895	36,039	843,790	20.8	25.4	20.9	25.4	.35	.43	.41	.50

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Money statement.

July 1, 1904, balance unexpended	$10,211.93
Amount allotted July 12, 1904	5,540.00
	15,751.93
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	12,855.57
July 1, 1905, balance unexpended	2,896.36
July 1, 1905, outstanding liabilities	836.36
July 1, 1905, balance available	2,060.00

ABSTRACT OF TOTAL LIABILITIES INCURRED IN EACH FISCAL YEAR.

During fiscal year ending June 30—		During fiscal year ending June 30—	
1895	$6,416.19	1903	$12,302.18
1896	30,800.15	1904	11,280.00
1897	35,180.41	1905	12,940.00
1898	19,487.80	Amount available June 30, 1905	2,060.00
1899	14,100.02		
1900	19,350.00		
1901	18,498.12	Total	196,914.87
1902	14,500.00		

ABSTRACT OF ALLOTMENTS.

January 25, 1895	$17,590.00	July 16, 1900	$20,610.00
June 15, 1895	18,852.91	September 28, 1900	7,000.00
June 20, 1896	5,000.00	August 12, 1901	12,948.12
July 24, 1896	23,471.98	July 16, 1902	13,300.00
For repairs to Pine River Reservoir	7,481.86	July 23, 1903	12,182.18
August 4, 1897	23,870.00	July 12, 1904	5,540.00
August 4, 1898	16,347.80	Total	196,914.87
August 15, 1899	12,720.02		

COMMERCIAL STATISTICS.

For commercial statistics, reference must be made to the reports upon the improvement of the Mississippi River.

REPORT OF MR. THOMAS ROBINSON, ASSISTANT ENGINEER.

PINE RIVER DAM,
Crosslake, Minn., June 30, 1905.

MAJOR: I have the honor to submit report on operating and care of reservoirs at the headwaters of Mississippi River during the fiscal year ending June 30, 1905.

Lake Winnibigoshish.—This reservoir was in full operation during the year. The bank protection below the debouchment of the log sluice was repaired by bolting 6-inch timbers on to the piles below the wales already there, and filling the space behind the piles with brush, crushed rock and sand.

The wave-breaking boom along the lake side of the dike was repaired, the telephone line was kept in order, and some painting was done to the tender's dwelling. At the close of June repairs were made to the dike near Bena, where 74 cubic yards of earth and 35 cubic yards of sods were used to strengthen the embankment. In

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the repairs of the bank protection, 3,120 feet B. M. of lumber, 30 bundles of brush, 18 cubic yards of crushed rock, 20 cubic yards of sand, and 2 cubic yards of bowlders were used, at a total cost for labor and team hire of $51. The cost of repairs to the boom for labor and team was $75.15. No charge was made on either of these jobs for lumber, bolts, etc., since a supply of these was on hand.

Leech Lake.—This reservoir was in full operation during the year. The dam and dike were in good order. The telephone line needed frequent repairs as the result of falling timber, and the dam tender's house was painted on the outside.

Pokegama Falls.—This reservoir was in operation throughout the year. Some minor repairs were done on the gauging station and the dam tender's house.

Pine River.—This reservoir was in operation throughout the year, but during the past four months its work was limited somewhat by the necessities of the work on reconstruction of the dam.

Sandy Lake.—This reservoir was in full operation during the year. An old building was removed and minor repairs were made to the woodwork of the dam and to the log booms. The right of way for the telephone line was cleared of brush and repairs were made to the line itself.

Respectfully submitted.

THOMAS ROBINSON,
Assistant Engineer.

Maj. GEO. McC. DERBY,
Corps of Engineers.

Z 4.

IMPROVEMENT OF ST. CROIX RIVER, WISCONSIN AND MINNESOTA.

The approved project and report of progress of the work up to June 30, 1904, will be found in the Report of the Chief of Engineers for 1905, Part 1, page 435.

During the past fiscal year there has been expended the sum of $1,662.94.

Owing to the limited amount of funds available no work was done during the year until after the passage of the river and harbor act, when the dredge fleet was put in thorough repair. The high stage of water has prevented the commencement of dredging operations.

Attention is invited to the report of Mr. R. Davenport, assistant engineer:

Money statement.

July 1, 1904, balance unexpended	$1,056.48
Amount appropriated by river and harbor act approved March 3, 1905	4,000.00
	5,056.48
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	1,662.94
July 1, 1905, balance unexpended	3,393.54
July 1, 1905, outstanding liabilities	51.00
July 1, 1905, balance available	3,342.54
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	3,600.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

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ABSTRACT OF APPROPRIATIONS.

By act—		By act—	
Approved June 18, 1878	$10,000	Approved July 13, 1892	$8,000
Approved March 3, 1879	8,000	Of August 18, 1894	4,000
Approved June 14, 1880	10,000	Passed June 3, 1896	15,000
Approved March 3, 1881	8,000	Approved March 3, 1899	9,000
Passed August 2, 1882	30,000	Approved June 13, 1902	2,000
Approved July 5, 1884	9,000	Allotted from act approved April 28, 1904	865
Approved August 5, 1886	7,500	By act approved March 3, 1905	4,000
Of August 11, 1888	10,000		
Approved September 19, 1890	8,000	Total	143,365

COMMERCIAL STATISTICS, SEASON OF 1904.

Rafted logs towed out of St. Croix River	feet B. M.	110,000,000
Rafted lumber, etc., towed out of St. Croix River:		
Lumber	feet B. M.	85,682,735
Shingles	number	23,523,500
Laths	do	20,412,400
Pickets	do	250,000
Total tonnage, exclusive of loose logs	tons	571,854
Loose logs run on river above Stillwater	feet B. M.	204,729,430
	tons	715,553
Number of steamboats engaged in rafting business out of Stillwater		30
Number of steamboats engaged in passenger excursion business		4
Passengers carried		7,500

REPORT OF MR. R. DAVENPORT, ASSISTANT ENGINEER.

ST. PAUL, MINN., *June 30, 1905.*

MAJOR: The following report of the improvement of the St. Croix River, Wisconsin and Minnesota, for the fiscal year ending June 30, 1905, is respectfully submitted:

Operations this season have been so far limited to the general repair of dredge *St. Croix* and two barges, at a total cost of $1,107.86. The cost of the repairs on the dredging fleet is divided between this work and the improvement of the Minnesota River, on both of which works the dredge is proposed to be used.

The last work of improvement on the St. Croix River was in the season of 1900, when the dredge was operated on the river between Taylors Falls and Stillwater dredging channels through the bars, constructing wing and training dams, and removing obstructions from the channel.

The last examination of the river, from Taylors Falls to Prescott, was made in 1903, when it was found that for the maintenance of the 3-foot low-water channel, repairs on the previously constructed wing and training dams, redredging of some of the bars, and the removal of numerous sunken logs and snags from the channel from Taylors Falls to Stillwater would be necessary, and that dredging through the bars and the rep ir of the training dams in the vicinity of Hudson, Wis., would be required to permit the movement of steamboats and rafts through Lake St. Croix at low-water stages.

Owing to the extreme high water in the St. Croix River this season and the probable filling up of the previously dredged channels and injury to the dams, a reexamination of the river between Taylors Falls and Prescott will be required.

Other than logging operations, there has been but little traffic on the St. Croix River during the past three or four years, the control of the water for logging purposes materially interfering with the successful operation of steamboats.

Regulations governing the control of the water on the lower St. Croix River, approved by the Secretary of War April 5, 1904 (Annual Report of the Chief of Engineers, Appendix Z, p. 2246), are still in force.

Respectfully submitted.

R. DAVENPORT,
Assistant Engineer.

Maj. GEO. MCC. DERBY,
Corps of Engineers.

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Z 5.

IMPROVEMENT OF MINNESOTA RIVER, MINNESOTA.

The approved project and the report of progress of the work up to June 30, 1904, will be found in the Report of the Chief of Engineers for 1905, Part 1, page 437.

There has been expended during the past fiscal year the sum of $131.32.

After the spring high water of 1903 had subsided a small break was discovered at the west end of the dam at the old mouth of the river. The dam is regularly inspected, and there does not appear to have been any material increase in the break since it was discovered. Repairs will be made as soon as the present high water will permit.

The dredge *St. Croix* will be used for dredging the channel at the outlet of the river. During the year the plant has been put in thorough repair, at a cost of $1,107.86, part of the cost having been paid from the appropriation for improving St. Croix River, Wisconsin and Minnesota. No other work has been possible this season on account of high water.

Money statement.

July 1, 1904, balance unexpended	$13.20
Amount appropriated by river and harbor act approved March 3, 1905	3,000.00
	3,013.20
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	131.32
July 1, 1905, balance unexpended	2,881.88
July 1, 1905, outstanding liabilities	180.41
July 1, 1905, balance available	2,701.47
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	1,400.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

ABSTRACT OF APPROPRIATIONS.

By act—		By act—	
Approved March 3, 1867	$37,500	Approved June 18, 1878	$10,000
Approved July 11, 1870	10,000	Of August 11, 1888	10,000
Approved March 3, 1871	10,000	Passed June 3, 1896	4,000
Approved June 10, 1872	10,000	Approved March 3, 1899	1,000
Passed March 3, 1873	10,000	Approved March 3, 1905	3,000
Approved June 23, 1874	10,000		
Approved March 3, 1875	10,000	Total	135,500
Approved August 14, 1876	10,000		

COMMERCIAL STATISTICS.

Owing to the precarious condition of the channel at the mouth of the river, navigation on the Minnesota River has been practically confined of recent years to irregular operations of excursion steamers from St. Paul, Hastings, Stillwater, etc., to Shakopee. The Minnesota River has also become a popular resort for a large number of steam and naphtha launches, operated from St. Paul and other river points.

Statistics of number of trips made and passengers carried by the various boats engaged in this navigation during the season of 1904 have not been obtainable.

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Z 6.

IMPROVEMENT OF RED RIVER OF THE NORTH, MINNESOTA AND NORTH DAKOTA.

The approved project and the report of progress of the work up to June 30, 1904, will be found in the Report of the Chief of Engineers for 1905, Part 1, page 438.

The expenditures during the year were $1,439.10.

During the year no work was done except to care for the plant at Grand Forks, N. Dak., and Thief River Falls, Minn., and assemble material for the repair of the dredge fleet at Grand Forks.

The repairs proposed are new hulls for the quarter boat and warehouse boat, at an estimated cost of $1,100, and the general repair of hulls and machinery of the steamer *Ogama* and dredge *Otter Tail* at an estimated cost of $650. The repairs are expected to be completed and the dredging fleet ready for work in the latter part of the month of August. The last work of improvement on the Red River was a short season's dredging on the bars to the north and south of Grand Forks in 1903. Since that time new bars have been reported in the river at low water in the vicinity of Grand Forks and at points both north and south of that place on which the dredge can be profitably occupied as long as the present appropriation will permit. The bars liable to give the most trouble to navigation are reported on the river south of Grand Forks, and it is expected that the first work of improvement required will be in that direction.

There not being sufficient funds to permit of any work on Red Lake River, the boats at Thief River Falls, which could not be taken below the Falls, were sold in June, 1905, by authority of the Secretary of War and the removable plant transferred to Grand Forks. There has been no work of improvement on Red Lake River since the season of 1900, when the river north of Thief River Falls was finally well cleared of obstructions in the shape of snags, bowlders, and overhanging trees. Regulations for the government of navigation, floating of loose logs, etc., were approved by the Secretary of War February 24, 1905.

Money statement.

July 1, 1904, balance unexpended	$1,865.32
Amount appropriated by river and harbor act approved March 3, 1905	9,000.00
Proceeds of sale of boats	70.00
	10,935.32
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	1,439.10
July 1, 1905, balance unexpended	9,496.22
July 1, 1905, outstanding liabilities	680.75
July 1, 1905, balance available	8,815.47
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement in addition to the balance unexpended July 1, 1905	7,500.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

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ABSTRACT OF APPROPRIATIONS.

By act—		By act—	
Approved August 14, 1876..	$10,000	Passed June 3, 1896.....	$20,000
Approved June 18, 1878....	30,000	Approved March 3, 1899 ...	25,000
Approved March 3, 1879...	25,000	Approved June 13, 1902....	10,000
Approved June 14, 1880....	20,000	Allotted from act approved April 28, 1904	1,623
Approved March 3, 1881...	18,000	By act approved March 3, 1905	9,000
Passed August 2, 1882.....	10,000		323,623
Approved July 5, 1884.....	10,000	Proceeds sale of boats.....	70
Approved August 5, 1886...	50,000		
Of August 11, 1888.....	20,000	Total	323,693
Approved September 19, 1890	25,000		
Approved July 13, 1892....	25,000		
Of August 18, 1894.....	15,000		

COMMERCIAL STATISTICS.

Red River of the North.—Two steamboats from 50 to 100 tons burden and about 30 inches draft, with a fleet of ten 100-ton barges, were operated on the river from Grand Forks, N. Dak. Total freight carried, 19,295 tons.

Red Lake River.—One steamboat of about 25 tons burden and about 30 inches draft was operated on river and lake traffic, and three steamboats from 50 to 100 tons burden and from 36 to 42 inches draft were engaged exclusively in lake traffic in connection with logging operations. Freight carried, 600 tons; passengers carried, 300; logs run, 115,000,000 feet B. M.

In addition to the foregoing, three small gasoline boats were operated irregularly in local passenger and freight traffic above Thief River Falls, but details are not obtainable.

Z 7.

IMPROVEMENT OF WARROAD HARBOR AND WARROAD RIVER, MINNESOTA.

The approved project and report of progress of the work up to June 30, 1904, will be found in the Annual Report of the Chief of Engineers for 1905, Part 1, page 440.

The expenditures during the past year were $11,250.08.

The work during the year consisted in dredging, both at the mouth of the river and on the outer bar in Lake of the Woods. The accompanying map shows the results to June 30, 1905. Details will be found in the appended report of Mr. R. Davenport, assistant engineer.

The improvement of the harbor at Warroad depends very largely upon the level of the Lake of the Woods, all estimates for dredging of the harbor and its approaches being based upon the maintenance of this level at or above the datum of 7.2 feet on the Warroad Harbor gauge. During the past year, however, the gauge reached that reading for only the half of one day, and it fell as low as 6 feet for several days during the season of navigation. The level of the lake is easily controllable by inserting or removing stop planks in the Keewatin dam near Rat Portage, Ontario, which is now under the control of the government of the Dominion of Canada. There are several water-power companies at and near the Keewatin dam, all of which would be benefited by the maintenance of the lake level at the highest possible datum, and there is much Canadian navigation on the lake which would also be benefited. Inasmuch, then, as all the interests concerned would seem to be only beneficially affected by preventing the

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level of the lake from falling below 7.2 feet, it seems likely that an agreement might readily be reached with the Canadian authorities to secure the maintenance of this minimum level at the Keewatin dam. Efforts in this direction are being made through the State Department.

Money statement.

July 1, 1904, balance unexpended	$14,106.73
Amount appropriated by river and harbor act approved March 3, 1905	35,000.00
	49,106.73
June 30, 1905, amount expended during fiscal year, for works of improvement	11,250.08
July 1, 1905, balance unexpended	37,856.65
July 1, 1905, outstanding liabilities	779.17
July 1, 1905, balance available	37,077.48

ABSTRACT OF APPROPRIATIONS.

By act approved—	
March 3, 1899	$3,000
June 13, 1902	45,000
March 3, 1905	35,000
Total	83,000

COMMERCIAL STATISTICS.

The town of Warroad, now five years old, has a population of about 1,000 and the adjacent country is rapidly filling up with settlers.

Up to this time Warroad Harbor has had no regular lake traffic, the condition of the entrance to the harbor not having been such as to permit it.

On Lake of the Woods there are at present twenty-five or more registered Canadian boats, ranging from 30 to 486 tons burden, some of which occasionally visit Warroad Harbor when conditions are favorable.

The United States boats connected with Warroad Harbor are the propellers *Na-ma-puk* and *Knute Nelson*, the former about 36 feet long and the latter about 80 feet.

REPORT OF MR. R. DAVENPORT, ASSISTANT ENGINEER.

ST. PAUL, MINN., *June 30, 1905.*

MAJOR: The following report of the improvement of Warroad Harbor and River, Minnesota, for the fiscal year ending June 30, 1905, is respectfully submitted.

Season of 1904.—Channel dredging was continued from station 1+50 to station 23 and from station 29 to station 44, excavating to an average depth of about 8 feet and a width of 100 feet. The increased depth made averaged about 2½ feet on the area worked over. Total excavation, 26,923 cubic yards. Average daily excavation, 259 cubic yards.

With the exception of a little superficial sand found well out in the lake, the material encountered in dredging throughout the entire season was found very difficult to excavate with the centrifugal pumps, being about equal quantities of hardpan and mud, the latter filled with the tough roots of bulrushes and other aquatic plants, all requiring the constant use of the revolving cutter before the material could be raised by the pumps. The time of 12.3 days was lost through stormy weather, when wind and sea made it impossible to operate the dredge.

The harbor was closed by ice, and dredging operations were closed for the season on October 29.

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Season of 1905.—Operations were commenced the 4th of April, setting up the dredge machinery and making minor repairs on the dredge and barges. Channel dredging was commenced April 24 and has been continued to this date, working from station 5 to station 23 and from station 28 to station 47, increasing the 100-foot channel to an average depth of about 9 feet, and the channel from station 4 to station 8 increased to a width of 150 feet. Total excavation, 28,282 cubic yards. Average daily excavation, 479 cubic yards. The material dredged this season has been mainly hardpan, requiring the constant use of the revolving cutter, but being free from plant roots, is much more readily being taken up by the pumps than the material dredged during the season of 1904. Time lost through stormy weather this season, 12.65 days.

Total excavation for the fiscal year, 55,205 cubic yards. Average cost of excavation, 13.03 cents per cubic yard. Cost of subsistence per ration, 39 cents.

The dredge *Warroad* has been so far operated with a single crew, working only in daylight, as in the original construction of the dredge quarters for a single crew only had been provided. By the temporary removal of the sandpit machinery space for additional quarters has been arranged, and the dredge will be prepared for running with a double crew shortly after the 1st of July.

A map of Warroad Harbor is herewith submitted showing the improvement made to this date.

Respectfully submitted.

R. DAVENPORT,
Assistant Engineer.

Maj. GEO. MCDERBY,
Corps of Engineers.

Z 8.

SURVEY OF OTTER TAIL LAKE AND OTTER TAIL RIVER, RED LAKE AND RED LAKE RIVER, MINNESOTA, AND BIG STONE LAKE AND LAKE TRAVERSE, MINNESOTA AND SOUTH DAKOTA.

The aproved project and report of progress of the work up to June 30, 1904, will be found in the Annual Report of the Chief of Engineers for 1905, Part 1, page 441.

Amount expended on all projects to June 30, 1905, $16,320.98.

No work was done during the year. The expenditures were for transportation in 1903–4.

It is proposed to reserve the available funds for the purpose of making hydrological observations during the next flood affecting these localities.

Money statement.

July 1, 1904, balance unexpended	$9,201.50
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	22.48
July 1, 1905, balance unexpended	9,179.02

ABSTRACT OF APPROPRIATIONS AND ALLOTMENTS.

By act—	
Passed June 3, 1896 (allotment for Big Stone Lake, etc.)	$2,500
Approved March 3, 1899—	
Appropriation for Big Stone Lake, etc	5,000
Appropriation for Red Lake and Red Lake River	5,000
Appropriation for Otter Tail Lake, etc	3,000
Approved June 13, 1902 (allotment for continuing surveys)	10,000
Total	25,500

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NOTE:
Odd numbered contours, gage at 7.2, survey of December 1899 and January 1900, shown hereon.

approved channel, thus:

redged to June 30, 1905, to an depth of 9 feet, and width feet, is hatched.

E.J.D.

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Z 9.

GAUGING MISSISSIPPI RIVER AT OR NEAR ST. PAUL, MINNESOTA.

The approved project and report of progress of the work will be found in the Report of the Chief of Engineers for 1905, Part 1, page 441.

The sum of $192.15 of the allotment of $500, made August 11, 1904, was expended in the purchase of necessary supplies and in keeping the record of the gauges between Lock No. 2 and the mouth of the Minnesota River when the stage of the river was such as to make additional data necessary.

Money statement.

Amount allotted August 11, 1904	$500.00
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	192.15
July 1, 1905, balance unexpended, returned to Treasury	307.85

Summary of expenditures during fiscal year ending June 30, 1905.

Supplies	$147.43
Services	44.72
Total	192.15

ABSTRACT OF ALLOTMENTS.

For fiscal year ending June 30—		For fiscal year ending June 30—	
1889	$900.00	1900	$500.00
1890	600.00	1903	500.00
1891	900.00	1904	500.00
1892	900.00	1905	500.00
1893	500.00		
1894	500.00	Total allotted	8,300.00
1895	500.00	Returned to Treasury	1,789.12
1896	500.00		
1897	500.00	Total expended	6,510.88
1898	500.00		

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APPENDIX A A.

IMPROVEMENT OF THE MISSOURI RIVER AND OF OSAGE AND GASCONADE RIVERS, MISSOURI.

REPORT OF MAJ. H. M. CHITTENDEN, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30. 1905, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Missouri River.
2. Osage River, Missouri and Kansas.
3. Gasconade River, Missouri.

HARBOR LINES.

4. Missouri and Kansas rivers at Kansas City, Missouri and Kansas.

UNITED STATES ENGINEER OFFICE,
Sioux City, Iowa, July 14, 1905.

GENERAL: I have the honor to submit herewith my annual reports upon the improvement of the Missouri, Osage, and Gasconade rivers for the fiscal year ending June 30, 1905. * * *

Very respectfully,

H. M. CHITTENDEN,
Major, Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

A A 1.

IMPROVEMENT OF MISSOURI RIVER.

The improvement work on the Missouri River during the past fiscal year has consisted in the maintenance of existing works and in snagging. For details see the reports of Assistant Engineers W. R. De Witt and E. D. Vincent.

The river and harbor act of March 3, 1905, contained the following items for work on the Missouri River:

Continuing improvement Missouri River at Saint Joseph, Missouri, and protecting work already done, all new work to conform to the established harbor line, fifty thousand dollars, provided the same is required in the interest of navigation: *Provided, further*, That no work shall be done at Saint Joseph until the public authorities shall contribute toward defraying the expense of said work an additional fifty thousand dollars, making the sum so contributed subject to the order of the Secretary of of War in such manner as he may direct, so that the expense of any work done under the provisions of this act shall be borne equally by the Government and out of the contribution herein provided for.

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Improving Missouri River: General improvement by snagging and maintenance of open-channel work, one hundred and seventy-five thousand dollars, of which amount ninety thousand dollars may be expended between the mouth and Sioux City, Iowa; ten thousand dollars for improvements at Hermann, Missouri, and seventy-five thousand dollars above Sioux City, Iowa.

Projects have been prepared and approved for the expenditure of these sums, as follows:

Work at special localities:

St. Joseph.—For building a longitudinal dike from the Grand Island bridge to the head of the Government revetment at Soap Creek, the dike to be on the established harbor line and to be connected with the shore by seven cross dikes. After the space behind the dike has become filled with accretion the front is to be protected with standard revetment.

The authorities of St. Joseph have contributed their portion of the cost of the work and operations have begun, but have not yet progressed beyond the purchase of material and the assembling of plant.

Hermann, Mo.—For building a strong dike from the left shore partly across Hermann Island Chute near the lower end, to check the flow through the chute and to protect the caving bank near its foot.

Maintenance of open-channel improvement on lower river:

For work at Omaha	$5,000
For work at Nebraska City, Nebr	500
For work at St. Joseph, Mo	15,000
For work at Little Blue reach	4,000
For work at Lexington, Mo	2,500
For work at Miami, Mo	300
For work at Wilhoit Bend	5,000
For work at First reach	25,000
For snagging (two seasons)	20,000
For contingencies	12,700
Total	90,000

Maintenance of open-channel improvement in upper river:

For work at Bismarck, N. Dak	$17,500
For work at Pierre and Fort Pierre	7,500
For work at Yankton, S. Dak	7,500
For work at Elkpoint, S. Dak	15,000
For work at Sioux City, Iowa	17,500
For snagging (two seasons)	18,000
For contingencies	5,000
Total	[a]88,000

Money statements.

UPPER RIVER.

July 1, 1904, balance unexpended	$25,294.97
Amount appropriated by river and harbor act approved March 3, 1905	75,000.00
	100,294.97
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	16,085.79
July 1, 1905, balance unexpended	84,209.18
July 1, 1905, outstanding liabilities	20,675.49
July 1, 1905, balance available	63,533.69

[a] Includes $13,000 from previous appropriation.

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LOWER RIVER.

July 1, 1904, balance unexpended	$73,399.19
Amount appropriated by river and harbor act approved March 3, 1905	150,000.00
Amount refunded on account of overpayment	.45
Amount contributed by citizens of St. Joseph, Mo	50,000.00
	273,399.64
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	77,455.64
July 1, 1905, balance unexpended	195,944.00
July 1, 1905, outstanding liabilities	21,954.91
July 1, 1905, balance available	173,989.09

ENTIRE RIVER.

Amount (estimated) required for completion of existing project ..... Indefinite.

APPROPRIATIONS AND ALLOTMENTS, EXCLUSIVE OF THOSE FOR SNAGGING, FOR IMPROVING UPPER MISSOURI RIVER.

August 14, 1876	$20,000.00	March 3, 1899	$205,000.00
June 18, 1878	42,500.00	June 13, 1902	100,000.00
March 3, 1879	60,000.00	Allotted by Secretary of War from act of June 13, 1902	2,000.00
June 14, 1880	43,000.00	March 3, 1905	75,000.00
March 3, 1881	66,000.00		
August 2, 1882	[a] 115,000.00	Total appropriations and allotments	1,963,500.00
July 5, 1884	140,000.00		
August 5, 1886	60,000.00	Received from sale of condemned property	342.16
August 11, 1888	200,000.00	Received from refundment	9.30
February 22, 1890	[b] 300,000.00		
July 13, 1892	[c] 150,000.00	Total	1,963,851.46
August 18, 1894	110,000.00		
March 2, 1895	40,000.00		
June 3, 1896	235,000.00		

In addition to the above amounts about $60,000 from the appropriations for the survey of the river from Fort Benton to the mouth was spent on the part above Sioux City.

APPROPRIATIONS FOR IMPROVING UPPER MISSOURI RIVER BY SNAGGING.

Allotments made from appropriations of 1890 and 1892 for improvement of upper Missouri River	$193,073.53
March 3, 1893	50,000.00
August 18, 1894	50,000.00
June 3, 1896	50,000.00
March 3, 1899	50,000.00
Total	393,073.53

APPROPRIATIONS AND ALLOTMENTS FOR IMPROVING MISSOURI RIVER FROM MOUTH TO SIOUX CITY, IOWA.

July 5, 1884	$640,000.00
August 5, 1886	375,000.00
August 11, 1888	1,000,000.00
February 22, 1890	75,000.00
September 19, 1890	800,000.00
July 13, 1892	600,000.00

[a] $2,832.42 of this transferred to work below Sioux City.
[b] $192,912 of this afterwards allotted to snagging.
[c] $163.51 of this afterwards allotted to snagging.

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March 3, 1893	$700,000.00	
August 18, 1894	700,000.00	
March 2, 1895	710,000.00	
June 3, 1896	300,000.00	
June 4, 1897	300,000.00	
July 1, 1898	300,000.00	
January 5, 1899	100,000.00	
March 3, 1899 (river and harbor)	100,000.00	
March 3, 1899 (sundry civil)	200,000.00	
June 6, 1900 (sundry civil)	250,000.00	
June 13, 1902	175,000.00	
Allotted by Secretary of War from act of April 28, 1904	50,000.00	
March 3, 1905	150,000.00	
Amount contributed by citizens of St. Joseph, Mo.	50,000.00	
Total specific appropriations		$7,575,000.00
Balance from former appropriations:		
Act of August 2, 1882, applied to works above Sioux City, Iowa	4,000.00	
Survey of Missouri River from mouth to Fort Benton	8,844.39	
Act of August 5, 1886, applied to removing obstructions from Missouri River	1,982.80	
Total balances		14,827.19
Refunded on account of overpayments, etc		3,469.58
Received from transfer of materials		3,322.71
Received from transfer of surplus property		7,556.15
Received from urgent deficiency act of February 18, 1904		19.35
Received from sale of condemned and surplus property		11,420.40
Total		7,615,615.38

COMMERCIAL STATISTICS, UPPER MISSOURI RIVER.

During the calendar year 1904 the number of boats engaged in carrying freight and passengers, exclusive of those doing a strictly ferriage business, was 8, with a total tonnage of 834. The freight and passengers carried by them are as follows:

	Tons.
Grain	6,493
Live stock	3,041
Lumber and wood	2,385
Building material and sand	12,441
General merchandise	4,591
Total	28,951

Passengers, 2,022. Commerce of upper river, expressed in mile tons, 1,528,834.

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List of steamers and gasoline boats plying on the Missouri River between Sioux City, Iowa, and Stubbs Ferry, Montana, during the year 1904.

Name.	Where built.	Year built.	Year enrolled.	Tonnage.	Dimensions.			Staterooms.	Berths.	Passengers.	Engines.		
					Length.	Breadth.	Depth.				Number.	Diameter.	Stroke.
					Feet.	*Feet.*	*Feet.*					*Inches.*	*Feet.*
Washburn	Bismarck, N. Dak	1901	1901	57.48	98.0	24.8	3.0	4	10	37	2	9	4.0
Expansion	Expansion, N. Dak	1899	1899	78.60	123.0	26.0	3.5	8	18	48	2	9	4.0
Jim Leighton	Pierre, S. Dak	1896	1896	109.00	119.8	30.0	4.0	.....	2	3	2	12	4.0
Josie L. K	Chamberlain, S. Dak	1884	1896	27.00	75.0	16.0	2.5	.....	.....	.....	2	6¼	1.5
F. Y. Batchelor	Pittsburg, Pa	1868	.....	313.00	190.0	30.0	4.5	7	14	64	2	13	5.0
Imelda	Fort Yates, N. Dak	1892	.....	30.00	90.0	17.0	2.0	.....	.....	.....	2	5	.....
Bismarck[a]	Bismarck, N. Dak	1896	1900	93.00	120.0	21.0	4.0	1	2	.....	1	.....	.....
Peerless[a]	Pierre, S. Dak	1897	1897	[b]50.00	83.0	21.0	3.5	.....	4	.....	1	.....	.....
Scotty Philip[a]	.....do	1900	1900	69.00	106.6	28.8	3.5	.....	2	1	1	13	1.8
Annie Austin[a]	.....	1898	.....	19.00	61.0	15.5	2.5	.....	.....	.....	.....	.....	.....
Vermillion[a]	.....	1901	.....	[b]20.00	51.0	20.5	2.5	.....	.....	.....	.....	.....	.....
Nellie L.[a]	.....	1900	.....	15.00	60.0	13.5	2.2	.....	.....	.....	.....	.....	.....
Cannon Ball[a]	.....	1895	.....	[b]20.00	71.0	14.0	3.2	.....	.....	.....	.....	.....	.....
Alace A.[a]	.....	1900	.....	18.00	61.5	16.5	2.5	.....	.....	.....	.....	.....	.....
Pride of the West[a]	.....	1899	.....	16.00	40.5	22.5	2.5	.....	.....	.....	.....	.....	.....
Little Maud	.....	1900	.....	89.00	105.0	28.0	4.5	.....	.....	.....	.....	.....	.....
Myrtle[a]	Pierre, S. Dak	1896	.....	7.00	32.0	7.0	3.0	.....	.....	.....	.....	.....	.....
Eda[a]	.....	1900	.....	22.00	39.0	24.0	2.5	.....	.....	.....	.....	.....	.....
Iowa[a]	.....	1897	.....	48.00	91.0	18.0	2.7	.....	.....	.....	.....	.....	.....
Swallow[a]	.....	1898	.....	17.00	48.0	10.5	4.5	.....	.....	.....	.....	.....	.....
Rose	.....	1886	.....	[b]9.00	44.0	10.0	2.9	.....	.....	.....	.....	.....	.....
Wm. Towle	Metropolis, Ill	1891	1903	95.00	90.0	16.0	3.0	4	8	[c]	2	.....	4.5
J. H. Keene[a]	Chamberlain, S. Dak	1903	1903	97.00	122.0	28.0	3.4	.....	.....	45	1	13	2¼

[a] Gasoline. [b] Estimated. [c] Open cabin.

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List of steamers and gasoline boats plying on the Missouri River between Sioux City, Iowa, and Stubbs Ferry, Montana, during the year 1904—Cont'd.

Name.	Boilers.					Iron or steel.	When built.	Steam pressure allowed.	Licensed to run.	Name of owner.
	No.	Length.	Diameter.	Flues. No.	Flues. Diameter.					
		Ft. in.	Inches.		Inches.					
Washburn	....	8 9	72	....	3	Steel....	1901	145	Missouri River	Benton Packet Co.
Expansion	....	9 0	72	....	3	...do....	1903	150	....do	Do.
Jim Leighton	....	22 0	42	8	8	...do....	.....	135	Missouri River between Bismarck and Sioux City.	Chicago and North Western Rwy.
Josie L. K	....	9 0	42	45	2¼	...do....	1900	140	Missouri River between Chamberlain and Sioux City.	Yankton Bridge and Ferry Co., Yankton, S. Dak.
F. Y. Batchelor	2	24 0	40	10	.....	Iron....	.....	145	Missouri River	Missouri River Transportation Co., Pierre, S. Dak.
Imelda	1	5 0	48	....	.....	.....	1892	200	.....do	Benton Packet Co.
Bismarck [a]	....	.....	.....	....	.....	.....	.....	.....	.....	Do.
Peerless [a]	....	.....	.....	....	.....	.....	.....	.....	Missouri River, Fort Benton and St. Louis.	Do.
Scotty Philip [a]	....	.....	.....	....	.....	.....	.....	.....	Missouri River	Missouri River Transportation Co., Pierre, S. Dak.
Annie Austin [a]	....	.....	.....	....	.....	.....	.....	.....	.....	H. I. Brown, Ponca, Nebr.
Vermillion [a]	....	.....	.....	....	.....	.....	.....	.....	.....	Ole Barrenson, Vermilion, S. Dak.
Nellie L. [a]	....	.....	.....	....	.....	.....	.....	.....	.....	Dennis Moran, Lake Andes, S. Dak.
Cannon Ball [a]	....	.....	.....	....	.....	.....	.....	.....	.....	J. D. Leach, Cannon Ball, N. Dak.
Alace A. [a]	....	.....	.....	....	.....	.....	.....	.....	.....	Pearson & Demar, Ionia, Nebr.
Pride of the West [a]	....	.....	.....	....	.....	.....	.....	.....	.....	A. B. Millick, St. Helena, Nebr.
Little Maud	....	.....	.....	....	.....	.....	.....	.....	.....	Missouri River Transportation Co.
Myrtle [a]	....	.....	.....	....	.....	.....	.....	.....	.....	E. E. Lindsay, Fort Pierre, S. Dak.
Eda [a]	....	.....	.....	....	.....	.....	.....	.....	.....	F. J. Whitthous, Wagner, S. Dak.
Iowa [a]	....	.....	.....	....	.....	.....	.....	.....	.....	J. W. Sanford, Chamberlain, S. Dak.
Swallow [a]	....	.....	.....	....	.....	.....	.....	.....	.....	Hutton & Brown, Springfield, S. Dak.
Rose	....	.....	.....	....	.....	.....	.....	.....	.....	N. Hilger, Helena, Mont.
Wm. Towle	1	28 0	54	5	.....	Steel....	.....	145	Missouri River, Kansas City to Fort Benton.	Richardson & Powers, Sioux City, Iowa.
J. H. Keene [a]	....	.....	.....	....	.....	.....	.....	.....	Missouri River, St. Louis to Fort Benton.	J. W. Sanford, Chamberlain, S. Dak.

[a] Gasoline.

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Commerce of the Missouri River from mouth to Sioux City, Iowa, during the calendar year 1904.

The long-distance trade was done by the St. Louis and Hermann Packet Company, of Hermann, Mo., with their steamer *Kennedy*, in the trade between St. Louis and Giles Landing.

This steamer and those engaged in the local trade carried 330 passengers during the year.

The following table, giving the amount of freight carried, towed, and rafted, but not including any ferriage, is an approximation to the lower Missouri River's trade for 1904:

TABLE 1.

Class.	Grain.	Live stock.	Lumber and wood.	Building material and sand.	General merchandise, farm machinery, etc.	Total.	Mile-tons.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	
Long-trade packets	1,189	185	1,650	115	1,538	4,677	971,315
Short-trade packets, miscellaneous boats, etc	6,648	2,066	4,174	5,800	792	19,480	392,568
Sand and wood steamers and barges	.....	.....	.....	402,149	.....	402,149	441,043
Rafts	.....	.....	4,459	.....	.....	4,459	117,810
Riprap, willows, and lumber used by private parties for bank protection in the vicinity of Kansas City and St. Joseph, Mo	.....	.....	.....	24,235	.....	24,235	317,920
Total	7,837	2,251	10,283	432,299	2,330	455,000	2,240,656

The following table gives the total, in tons, for the different classes of trade during the last six years for the lower Missouri:

TABLE 2.

Class.	1904.	1903.	1902.	1901.	1900.	1899.	1898.
Long-trade packets	4,677	2,376	7,989	7,806	4,397	715	3,641
Short-trade packets, etc	19,480	51,505	38,051	87,588	34,787	37,610	39,245
Sand and wood steamers and barges	402,149	678,878	334,164	463,340	232,395	218,514	252,152
Rafts	4,459	1,985	12,073	10,935	5,727	6,275	5,755
Mattress brush, stone, and dike material for bank protection	24,235	15,547	18,250	.....	.....	.....	19,000
Total	455,000	750,291	410,527	569,669	277,306	263,114	319,798

TABLE 3.—*Comparative commerce of the lower Missouri River, expressed in mile-tons.*

Class.	1904.	1903.	1902.	1901.	1900.	1899.	1898.
Long-trade packets	971,315	494,746	1,435,605	999,116	558,807	98,193	526,304
Short-trade packets, etc	392,568	1,250,966	626,925	1,039,767	380,378	410,530	522,872
Sand and wood steamers and barges	441,043	149,994	429,492	668,783	460,440	422,606	359,948
Rafts	117,810	95,911	570,137	196,872	103,975	126,432	145,437
Mattress brush, stone, and dike material for bank-protection work	317,920	237,714	164,750	.....	.....	.....	375,000
Total	2,240,656	2,229,331	3,226,909	2,903,538	1,483,600	1,057,761	1,929,561

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REPORT OF MR. W. R. DEWITT, UNITED STATES ASSISTANT ENGINEER.

SIOUX CITY, IOWA, *June 30, 1905.*

MAJOR: I have the honor to submit the following annual report of operations on the Missouri River from Sioux City, Iowa, to its mouth, for the current fiscal year ending June 30, 1905:

Owing to the small amount of available funds no new work was undertaken, and operations were confined to the maintenance of the old works and their protection by additional work in their immediate vicinity, care of and repairs to plant, and snagging.

The work was carried on in accordance with your approved projects, with funds derived from the following sources:

Balance July 1, 1904, of appropriation for improving Missouri River from Sioux City, Iowa, to its mouth, river and harbor act of June 13, 1902	$23,399.19
Amount appropriated by river and harbor act of April 28, 1904	50,000.00
Amount refunded on account of overpayment	.45
Amount appropriated by river and harbor act of March 3, 1905	150,000.00
Amount contributed by citizens of St. Joseph, Mo	50,000.00
Total available	273,399.64
Total expenditures for fiscal year ending June 30, 1905, including outstanding liabilities	99,410.55
Balance available July 1, 1905	173,989.09

PROJECTS.

1. Project of July 27, 1904, approved August 6, 1904, for the expenditure of $50,000, provided by river and harbor act of April 28, 1904, as follows:

Omaha, Nebr.: Repairs to revetment on the Council Bluffs side		$5,000
Nebraska City, Nebr.: Repairs to longitudinal dike to insure against its being flanked		500
Kansas City, Mo.: Extension of the East Bottoms revetment, to secure bank line above Randolph bridge		5,000
Near mouth of Little Blue: Repairs to pile dikes		500
Lexington, Mo.: Repairs to pile dikes		300
Miami, Mo.: Repairs to dike opposite town		500
Wilhoit Bend:		
Repairs to three bankheads	$2,000	
Construction of 300 feet 3-row pile dike, to reenforce bankheads 4C and 5C	3,000	
		5,000
Cambridge Bend: Restoration of pile dike built in 1898		1,500
Nigger Bend: Revetment repairs		500
Murray Bend: Revetment repairs		2,000
First reach:		
Dike repairs	1,200	
Closing Cedar Island Chute	300	
		1,500
Chamois, Mo.:		
Extension of revetment at the head to prevent further destruction, 800 linear feet	8,000	
Restoration of St. Aubert Island dike	2,000	
Construction of 300 linear feet of pile dike, to protect the root of Dike 22A, opposite the head of the Chamois revetment	2,500	
		12,500
Portland Island: Construction of 400 linear feet of pile dike		3,200
Howard Bend: Repairs to bankhead 6F		2,000
Snagging		10,000
Total		50,000

2. Project of April 6, 1905, approved April 14, 1905, for the expenditure of $90,000 provided by river and harbor act of March 3, 1905, as follows:

Omaha, Nebr.: Repairs to revetment on Iowa side of river and below Terminal Railway bridge	$5,000

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Nebraska City, Nebr.: For rescreening the entire system of dikes		$500
St. Joseph, Mo.: For general repairs to works in Bonton, Elwood, and Belmont bends		15,000
Little Blue Reach:		
Repairs to dikes	$1,000	
For construction of 3 short pile dikes, below bankhead 3A, to protect the bankhead	3,000	
		4,000
Lexington, Mo.: For repairs to dikes opposite town and building two new dikes		2,500
Miami, Mo.: For repairs to dike opposite town		300
Wilhoit Bend: For building 3 new short dikes to protect bankheads 4C and 5C, and making general repairs		5,000
First Reach:		
For making repairs to Murray Bend revetment	$15,000	
For general repairs to old works and protecting same with new work where necessary	10,000	
		25,000
For snagging (two seasons)		20,000
For contingencies		12,700
Total		90,000

3. Project of April 3, 1905, approved April 28, 1905, for the expenditure of $100,000 at St. Joseph, Mo., $50,000 of which is provided by river and harbor act of March 3, 1905, and $50,000 by local interests, as follows:

Construction of 4,400 linear feet of 3-row longitudinal dike, extending from head of revetment at mouth of Soap Creek to Grand Island Railway bridge	$54,000
Constructing about 1,600 linear feet of cross dikes	10,000
Constructing standard revetment along line of accretions formed by above dikes	36,000
Total	100,000

4. Project of May 5, 1905, approved June 15, 1905, for the expenditure of $10,000 for improvement at Hermann, Mo., provided by river and harbor act of March 3, 1905, as follows:

For construction of 700 linear feet of 4-row pile dike near foot of chute, opposite Hermann, Mo	$10,000

PLANT.

The following pieces were more or less actively engaged during the working season:

1 snag boat, *James B. McPherson.*
2 steam tenders, *Arethusa* and *Atalanta.*
2 pile drivers.
1 hydraulic grader.
2 mat boats.
2 construction quarter boats.
2 small office boats.
12 barges, 25 by 100 feet.

These pieces were kept in good repair, being pulled out on the storage ways and relaunched when necessary.

New timber foundations were placed under the engine and the building of the steam sawmill.

All plant in storage and in harbor at mouth of the Gasconade River was cared for by a small force of watchmen.

The expenditure for the year on account of this work was:

For watching and labor on account of plant	$4,258.26
For repairs to plant, including materials and labor	10,862.65
For labor of handling construction materials, outfitting field parties, etc.	2,068.81
Total	17,189.72

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During the year, active work was carried on at points and with items of cost in the field, as shown below:

Omaha, Nebr.—The revetment on the Iowa side of the river, about 4 miles above Council Bluffs, had been damaged by being flanked, and was being unraveled from the upstream end, when on December 5, 1904, a small force was organized and commenced work with a view of preventing further damage.

Between the above date and January 1, 1905, the following work was done:

Six hundred feet of bank at present head of revetment was graded and paved, expending 1,200 tons of riprap stone; 784 tons of stone was placed on the subaqueous mattress; one brush and stone dike, 70 feet in length and sloped from top of bank to low water, was built in a pocket excavated in the main bank by the current.

The cost of this work $2,458.79.

Nebraska City, Nebr.—In order to prevent the longitudinal dike at the head of the system of dikes opposite town from being flanked, 455 tons of riprap stone was placed at its root and on bank above, between January 1, 1905, and January 18, 1905, at a cost of $368.96.

Between June 1 and 16, 1905, the entire system of dikes at this place was screened at a cost of $147.49.

Nearman Bend, Kans.—In order to prevent further destruction at the present head of the revetment in Nearman Bend a small force was organized April 26, 1905, and put to work sloping the bank and placing brush and rock fascines, 273 fascines being made and placed, covering 500 linear feet of bank, completing the work as contemplated May 16, 1905, when the force was disbanded.

Ths cost of this work was $959.91.

Kansas City, Mo.—In order to secure the bank line above the Chicago, Milwaukee and St. Paul Railroad bridge the East Bottoms revetment was extended downstream 523 linear feet between August 16 and September 14, 1904, at a cost of $5,100.38.

Near mouth of Little Blue.—Between the dates of September 8 and 21, 1905, the ends of the two Hiffner dikes and the dike in Irish Jimmy Chute were strengthened by driving and bracing 17 piles and rescreening 240 linear feet at a cost of $860.34.

Lexington, Mo.—The work here consisted in driving and bracing 9 piles at end of Dike No. 3 and rescreening 80 feet of the same dike, and was done between September 20 and 24, at a cost of $406.58.

Miami, Mo.—The work here consisted of driving and bracing 14 piles at end of dike opposite town, weaving and ballasting an apron mattress containing 6,650 square feet and rescreening 80 linear feet. The work was done between September 27 and October 4, at a cost of $649.33.

Wilhoit Bend.—The work here was commenced October 3 and was completed November 5, 1904, and consisted in the construction of two 3-row pile dikes just above bankhead 4C, three 3-row pile dikes just above bankhead 5C, each 77 feet in length, and in making general minor repairs to the bankheads. The cost of this work was $5,538.80.

Cambridge Bend.—In 1898 a 2-row circular dike 300 feet long was built at the foot of the Cambridge revetment to prevent its destruction by eddy action.

When the flood of 1903 passed down the river this structure had so far deteriorated that it was entirely taken out by the flood, except the subaqueous mattress.

This structure was rebuilt, using the old mattress as a foundation, between October 25, 1904, and November 5, 1904, at a cost of $1,519.37.

Nigger Bend.—This revetment was found to be in good condition except that a small pocket had formed at its head, and to prevent damage by eddy action the force, in moving down the river from Wilhoit Bend, stopped here one day and placed 45 brush and rock fascines at the head of the work, at a cost of $185.16.

FIRST REACH.

Murray Bend.—This revetment showed a stretch of 1,800 linear feet, beginning at a point 1,000 feet below its head and extending downstream, of upper bank work that was beginning to disintegrate. As a temporary means of relief this stretch of bank was covered with brush and rock fascines, 682 being made and placed between November 7 and November 30, at a cost of $3,655.93, or about $2.03 per linear foot of bank protected. It is a question of only a short time when this revetment must either be rebuilt or protected with pile dikes.

Jefferson City, Mo.—The system of dikes just above the bridge at this place is showing signs of rapid decay where the ends of the dikes are subject to strain from ice and drift.

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Between November 7 and 23 the following work was done:

Dike A.—Gap of 50 feet filled in with new work and the end of the dike strengthened.

Dike B.—The exposed end of this dike was rebraced and rescreened, and 6 new piles were driven in the trail.

Dike C.—Three bents were rebraced and 60 linear feet rescreened.

Dike D.—Six piles were driven and braced in the trail and 270 linear feet rescreened.

Dike E.—A gap of 30 feet was closed with new work and 220 linear feet was rescreened.

Dike F.—A cluster of 3 piles was driven above the end of this dike to form ice break and 370 linear feet was rescreened.

This work was done at total cost of $1,244.66.

Cedar Island Chute.—In order to reenforce work already done to confine the water to the main channel a fascine dike was thrown across the chute just below the old work the first week in December, 1904, at a cost of $275.76.

Chamois, Mo.—Chamois revetment.—Between August 29 and September 17, 1904, the Chamois revetment was extended upstream 834 linear feet, at a cost of $6,010.12.

Dike construction opposite head of Chamois revetment: In order to protect the root of Dike 22A and prevent the channel from leaving the right bank, six 3-row pile dikes were built, three of which are 85 feet long each, one 95 feet long, and two 70 feet long each, spaced 300 feet apart and 300 feet above Dike 22A.

Four of these dikes were built September 15 to October 11, 1904, and the other two during latter part of March and first part of April, 1905.

The total cost of this work, together with that of some minor repairs to old dikes, was $7,192.

St. Aubert Island dikes.—Since the flood of 1903 the bank line above the head of the St. Aubert Island revetment had receded considerably and the revetment was threatened by being flanked. In order to prevent the destruction of this work, two 3-row pile dikes, one 120 feet in length and one 80 feet in length, were built, the short one 75 feet above the head of the revetment and the dikes spaced 225 feet. These dikes were built in October, 1904, at a cost of $2,323.86.

The ice breakup of last winter took out 30 linear feet of this work and cut away a little of the revetment, all of which was repaired during the month of April, 1905, at a total cost of $969.58.

Dikes below Chamois revetment.—Dikes 12 and 13 of this system of dikes were badly broken up by the last winter's ice, necessitating the work of driving and bracing 16 piles in Dike 12 and 28 in Dike 13. The entire system was rescreened. This work was done during the last ten days in April, 1905, and cost, with the additional cost of some minor repairs made in October, 1904, $1,019.80.

St. Aubert revetment.—The revetment built in St. Aubert Bend in season of 1895 to 1896 was slightly damaged near its center by having a pocket gouged out of the upper bank. Between April 19 and 24, 1905, 110 brush and rock fascines were made and placed in this pocket, to cause the bank to be refilled by sediment. The cost of this work was $663.34.

Portland Island.—The work at this place consisted in the construction of four 3-row spur dikes, average length 75 feet, spaced 300 feet apart, near the head of the island, to strengthen the system of old dikes below, general repairs to old dikes in this vicinity, and closing 2 dry sloughs.

Work was commenced October 27 and completed November 28, at a cost as follows:

Construction of 4 dikes	$4,180.03
Repairs to old dikes	324.96
Building 175 linear feet of curtain fences to close 2 dry sloughs	450.93
Total	4,955.92

Heckmans Island.—The head of this island was being rapidly cut away, threatening the destruction of the revetment on the main channel side. To obviate this, 150 linear feet of bank was protected with fascine work, and a short fascine dike built across the head of the chute between the island and the main shore, a part of the work being done in December, 1904, and the balance in May, 1905, at a total cost of $845.62.

Pelican Bend.—The work here consisted in building a brush and stone dike 60 feet in length across an excavation made back of the revetment near its foot by the flood of 1903 and replacing a little of the paving which had been cut out. The work was done between December 16 and 29, 1904, at a cost of $504.24.

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SPECIAL APPROPRIATION AT ST. JOSEPH, MO.

PLANT.

Four 20 by 70 foot barges and one steam pile driver were repaired at the Sioux Ice Harbor above Sioux City, Iowa, at a cost of $614.11, and on June 30, 1905, were in transit to St. Joseph, Mo., in tow of the chartered steamer *F. Y. Batchelor*. Two 25 by 100 foot barges and one mattress boat were towed from Gasconade, Mo., to St. Joseph, Mo., by U. S. steam tender *Arethusa*, arriving at their destination June 30, 1905. This will complete the assembling of the working plant at this point.

All materials for this work have been ordered, and up to June 30, 1905, two cars of bracing timber and some small materials, such as bolts, strand, etc., had been received and stored. Active operations will be commenced as soon as the high water subsides sufficiently to permit the work to be done.

Special appropriation at Hermann, Mo.—Nothing has been done on account of this work beyond ordering all necessary materials.

SNAGGING.

The snag boat *James B. McPherson* was placed in commission July 31, 1904, and was cleared from Gasconade, Mo., with a construction outfit in tow, bound for Kansas City, Mo., where she arrived August 10. Between the dates of August 10 and 17, she was used to make an inspection trip from Kansas City, Mo., to the mouth of the river.

The boat was greatly in need of repairs and laid up at St. Louis, Mo., from August 17 to 30, during which time her entire machinery was overhauled and repaired.

On August 30, 1904, she commenced her regular work of snagging at the mouth of the river, and by November 5 had worked her way to Kansas City, Mo., and back to Jefferson City, Mo., when, with yourself and the writer aboard, she started downstream on a trip of inspection, arriving at St. Louis, Mo., November 8.

After undergoing minor repairs and coaling she again resumed snagging operations, working upstream. She arrived at the boat and supply yard at Gasconade, Mo., November 15, and went into winter quarters.

The following work was accomplished during the season:

Snags removed	639
Wrack heaps removed	7
Number of trees felled and removed from caving banks	1,020
Miles run:	
Downstream	816
Upstream	816

The expense of operating the snag boat for the season was:

While engaged in snagging	$7,493.88
While towing plant and making inspection trips	1,619.37
Total	9,113.25

INSPECTION OF WORKS, EXAMINATIONS, AND SURVEYS.

Omaha, Nebr.—An examination of the revetment at the "Narrows," on the Iowa side of the river, was made September 14, 1904, and report submitted to you under date of September 15, 1904.

In response to a call from Mayor McCrae, of Council Bluffs, Iowa, an examination of the revetment below the Terminal bridge was made February 4, 1905, and report submitted to you under date of February 6, 1905.

The Omaha Bridge and Terminal Railroad Company's bridge at East Omaha, Nebr., the reconstruction of which was finished January 1, 1905, was measured January 4, 1905, and the work found to be done in accordance with approved plans. A record of same has been placed on file.

Florence Lake revetment.—At request of Mr. H. W. Parkhurst, assistant engineer of bridges, Illinois Central Railroad Company, an examination of this revetment was made June 20, 1905, and special report submitted to you under date of June 26, 1905.

St. Marys Bend, below Omaha, Nebr.—By request of Congressman Walter I. Smith, of Council Bluffs, Iowa, an examination was made of the river in the vicinity of St. Marys Bend in company with State Senator Shirley Gilliland, and Seth Dean, county surveyor of Mills County, with a view of permitting a cut-off to be made through the sand bar on the right bank, to relieve the erosion of the left bank.

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A special report on the matter was submitted to you under date of July 29, 1904.

Nearman Bend, above Kansas City, Mo.—By request of Miss Lyda B. Conley, of Quindaro, Kans., two examinations of the river at Nearman Bend were made August 25, 1904, and March 7, 1905, and reports submitted to you under dates of August 26, 1904, and March 7, 1905.

Kansas City, Mo.—On complaint of H. H. Clark that A. W. Farney was obstructing the channel by building a brush dike at Island Park, above Kansas City, Mo., an examination of the site of the alleged dike was made June 28, 1905, and special report submitted to you under date of June 29, 1905.

Kaw River.—An examination of levee built on bank of Kaw River by Kaw Valley Townsite Company was made December 23, 1904, and a special report submitted to you under same date.

Wilhoit Bend, above Glasgow, Mo.—An examination of the river in this vicinity was made July 20, 1904, and a special report submitted to you under date of July 21, 1904.

Hermann, Mo.—At request of Capt. Wm. L. Heckmann, of Hermann, Mo., an examination of the river was made in vicinity of Hermann July 15, 1904, and a special report submitted to you on the same date.

An examination and survey were made of the Hermann Island Chute March 17, 1905, and a special report and project submitted to you by letter of same date.

In company with yourself, another examination was made of the Hermann Island Chute March 31, 1905, from which resulted your project for the expenditure of $10,000, submitted to the Chief of Engineers under date of May 5, 1905, and approved June 15, 1905.

An elaborate survey was made of the river in the vicinity of Hermann, Mo., during month of April, 1905, a map prepared and submitted to you, with project for the expenditure of $10,000, May 2, 1905.

Bellefontaine Bend, near mouth of river.—In company with Hon. Richard Bartholdt, of St. Louis, Mo., an examination of the river in the vicinity of Bellefontaine, or Cora Bend, was made on August 2, 1904, and report submitted to you under date of August 3, 1904.

Pelican Bend.—An examination of the Pelican Bend revetment was made December 16, 1904, and special report submitted to you same date.

All works below Kansas City, Mo., were inspected between the dates of August 11 and 17, 1904, and all below Jefferson City, Mo., between the dates of November 5 and 8, 1904.

Between the dates of March 22 and April 3, 1905, an examination was made at each of the following places, in order to submit a project for work at those places: St. Joseph, Mo.; Little Blue reach, Lexington, Mo.; Wilhoit Bend, Howard Bend, and Nebraska City, Nebr.

Very respectfully,

W. R. DE WITT,
Assistant Engineer.

Maj. H. M. CHITTENDEN,
Corps of Engineers.

REPORT OF MR. E. D. VINCENT, UNITED STATES ASSISTANT ENGINEER.

SIOUX CITY, IOWA, *May 1, 1905.*

MAJOR: I have the honor to report as follows on the improvement work of upper Missouri River, to April 30, 1905:

No new work was undertaken and expenditures have been confined to the maintenance and repairs of existing work.

Sioux City, Iowa (and Nebraska shores).—The improvement work at these points have sustained no damage except the dike protecting the Nebraska approach to the combination bridge, the head of which should be replaced, but this can only be done at a flood stage of the river as the channel now follows the Iowa shore. The amount expended at this point the past season for miscellaneous repairs was $687.97.

Elkpoint, S. Dak.—During the high water of last season a break occurred in the revetment at this point, aggregating 200 linear feet in extent. These breaks were repaired during the past winter at a cost of $540.33.

Yankton, S. Dak.—No damage has been done to the existing work in the vicinity of Yankton the past season, therefore no repair work has been contemplated. Proportional cost of maintenance of plant for this point amounts to $394.31.

Pierre, S. Dak.—The breakup at this point last spring and the annual June rise did no damage to the existing works with the exception of a break in some of the bracing in the dikes at Fort Pierre. These were repaired during the winter. The spring

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breakup of this year took out the entire head of the upper dike at Fort Pierre and the same should be replaced. The cost of maintenance and watchman's services at this point for this year to date amounts to $878.21.

Bismarck, N. Dak.—At Bismarck the high water of last year flanked Dike No. 1 of the system in front of Mandan and also damaged Dike No. 3 at its shore end. A break was also developed in the revetment below the dike system. Repair work was carried forward at this point during the winter and was completed in March. The total amount expended for watchman's services and repair work to date is $2,001.09.

Snagging.—The snag boat *Mandan* left the harbor at Sioux City, Iowa, for upper river points August 11, 1904. She covered the river as far as Pierre, S. Dak., reaching that point September 4; turned back from that point September 7 and snagged in the vicinity of Sioux City until October 25, when she was returned to winter quarters in the Sioux Ice Harbor. The crew was disbanded October 28. During the seventy-six days the boat was operating she covered 960 miles of river and removed 335 snags, 5 miscellaneous obstructions, and felled 10 trees. The boat's operating expenses during the season, her care during the winter, and her overhauling this spring amounted to $5,848.49.

The office expenses for the upper river for the year to this date is reported as $1,173.49, and the total expenditures covering all points is $11,524.35.

Respectfully submitted.

E. D. VINCENT,
Assistant Engineer.

Maj. H. M. CHITTENDEN,
Corps of Engineers.

REPORT OF MR. W. R. DE WITT, UNITED STATES ASSISTANT ENGINEER.

SIOUX CITY, IOWA, *June 30, 1905.*

MAJOR: I have the honor to submit the following report of operations on the upper Missouri River, between Sioux City, Iowa, and Stubbs Ferry, Mont., covering the period from May 1 to June 30, 1905, this work being placed in my charge on the first-named date:

Operations for the above-named period comprised examinations, care of and repairs to plant, and making preparations for the coming season's work.

Balance available from previous appropriations May 1, 1905	$11,738.52
Appropriated by act of Congress March 3, 1905	75,000.00
	86,738.52
Expenditures for May and June, 1905	4,163.35
Balance available July 1, 1905	82,575.17

Your project for the coming season's work, approved by Chief of Engineers June 14, 1905, provides for the expenditure of $88,000 ($75,000 new appropriation and about $13,000 carried over) for such work as is necessary for the maintenance of existing works or their extension and completion, and snagging, as shown below.

For two season's snagging operations	$18,000
Sioux City, Iowa	17,500
Elkpoint, S. Dak	15,000
Yankton, S. Dak	7,500
Pierre, S. Dak	17,500
Contingencies	5,000
Total	88,000

Office and contingent expenses to be apportioned pro rata to the above works as nearly as possible.

PLANT.

On May 1, 1905, all available working plant belonging to this work was located at the following points, all needing repairs:

Bismarck, N. Dak.:
1 mattress barge, 24 by 100 feet.
1 barge, 22 by 101 feet.
1 barge, 19 by 70 feet.
1 steam pile driver.

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Pierre and Fort Pierre, S. Dak.:
6 barges, 20 by 70 feet.
1 steam pile driver.
Sioux City, Iowa (Sioux Ice Harbor):
11 barges, 20 by 70 feet.
2 barges.
2 steam pile drivers.
1 towboat (*Robert*).

The steam pile driver and one barge were undergoing repairs at Fort Pierre, S. Dak., on May 1, 1905. This work was completed May 20, 1905.

Work was commenced on repairs to the plant at the Sioux Ice Harbor, above Sioux City, Iowa, June 7, 1905; and June 30, 1905, the following work had been accomplished:
4 barges, 20 by 70, repaired and launched.
1 barge, 20 by 70, completed.
1 steam pile driver, 75 per cent completed.
1 towboat (*Robert*), 75 per cent completed.

The expenditures on account of plant for May and June, 1905, were:

Bismarck, N. Dak.: Care of plant		$110.00
Pierre and Fort Pierre, S. Dak.:		
Care of plant	$110.00	
Repairs to plant	141.60	
		251.60
Yankton, S. Dak.: Care of property		24.00
Sioux City, Iowa:		
Care of plant	65.00	
Repairs to plant	530.18	
		595.18

SNAGGING.

On May 1, 1905, the snag boat *Mandan* was operating at her regular work of snagging at Fort Thompson. During the months of May and June, 1905, she had covered the river between and 35 miles below Bismarck, a point 127 miles above Bismarck, being at Bismarck, N. Dak., June 30, 1905.

The following was accomplished at a cost of $2,825.35:

Snags removed from channel	73
Trees felled and removed from caving banks	1,737
Miles run:	
Upstream	617
Downstream	201
Total	818

EXAMINATIONS.

An examination of the works at Pierre was made June 12, 1905. On receipt of a report that the river was cutting into the left bank at the proposed Norfolk bridge crossing above Yankton, S. Dak., endangering the safety of some riprap stone in storage at that place, Junior Engineer E. C. Bowen made a trip of inspection June 27, 1905, moved the stone back and submitted a special report to you dated June 28, 1905.

An examination of conditions in the vicinity of Jacksons Chute was made June 30, 1905, by Junior Engineer E. C. Bowen, and a special report submitted to you under date of June 30, 1905.

Respectfully submitted.

W. R. De Witt,
Assistant Engineer.

Maj. H. M. Chittenden,
Corps of Engineers.

A A 2.

IMPROVEMENT OF OSAGE RIVER, MISSOURI.

No work was done on this river during the working season of 1904. The river and harbor act of March 3, 1905, contained the following item for the Osage River:

Improving Osage River, Missouri: Continuing improvement and for maintenance, eighty thousand dollars.

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A project has been approved providing for the expenditure of so much of this sum and of the balance remaining from previous appropriations as may be necessary for the completion of Lock and Dam No. 1. Operations were begun immediately upon the passage of the act and have consisted in the repair of plant, assembling of material, and in other preparations. Actual construction work will have to await the subsidence of high water.

Money statement.

July 1, 1904, balance unexpended	$15,040.96
Amount appropriated by river and harbor act approved March 3, 1905	80,000.00
	95,040.96
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	6,109.68
July 1, 1905, balance unexpended	88,931.28
July 1, 1905, outstanding liabilities	7,020.66
July 1, 1905, balance available	81,910.62
Amount (estimated) required for completion of existing project	Indefinite.

APPROPRIATIONS AND ALLOTMENTS.

August 18, 1894	$46,000.00
June 3, 1896	50,000.00
March 3, 1899	25,000.00
June 6, 1900	146,000.00
June 13, 1902	30,000.00
Balances transferred January 15, 1895, from Maj. Charles J. Allen, Corps of Engineers:	
September 19, 1890	42,655.18
July 13, 1892	43,366.44
Refunded on account of overpayment	10.69
March 3, 1905	80,000.00
Total	463,032.31

COMMERCIAL STATISTICS.

The steamboat traffic on the Osage River was performed principally by the steamers *J. R. Wells* and *Nadine* and gasoline boat *Lillie*, carrying 140 passengers.

TABLE 1.—*Close approximation to the amount of river trade during 1904.*

Class.	Grain.	Live stock.	Lumber and wood.	Railroad ties.	Building material and gravel.	Barytes.	General merchandise, farm machinery, etc.	Total.	Miletons.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	
Packets	466	827	518	267	14,573	75	1,430	18,156	294,104
Rafts, etc	.....	.....	49	17,541	.....	.....	.....	17,590	980,416
Total	466	827	567	17,808	14,573	75	1,430	35,746	1,274,520

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TABLE 2.—*Comparative statement of the commerce of the river, expressed in tons, from 1904 to 1897.*

Shipments.	1904.	1903.	1902.	1901.	1900.	1899.	1898.	1897.
Hay and grain	466	1,498	6,000	4,232	8,722	4,077	3,418	1,598
Live stock	827	489	153	1,058	934	873	1,038	909
Lumber, wood, and ties	18,375	24,256	74,385	56,221	76,583	57,663	74,881	66,175
Building material and gravel	14,573	10,639	12,369	8,000	7,500	9,945	3,015	1,350
General merchandise, farm machinery, etc	1,430	1,534	2,284	2,738	2,335	4,144	1,934	1,215
Barytes	75	85	3	90	70	.....	.....	.....
Total	35,746	38,501	95,194	72,339	96,144	76,702	84,286	71,247

TABLE 3.—*Comparative commerce of the river, expressed in mile-tons, from 1904 to 1897.*

Class.	1904.	1903.	1902.	1901.	1900.	1899.	1898.	1897.
Packets	294,104	263,018	675,705	277,106	545,107	393,136	349,955	178,695
Rafts, etc	980,416	970,723	3,334,065	2,425,710	3,060,215	2,968,121	3,825,099	3,707,200
Total	1,274,520	1,233,741	4,009,770	2,702,816	3,605,322	3,361,257	4,175,054	3,885,895

A A 3.

IMPROVEMENT OF GASCONADE RIVER, MISSOURI.

The act of June 13, 1902, appropriated the sum of $10,000 for the Gasconade River. A project for its expenditure, approved by the Chief of Engineers, July 26, 1902, provided for two seasons' work, to consist of removal of snags and other obstructions, the building of wing dams, and doing such other work as would yield immediate benefit to the channel.

During the past season operations have been carried on at Sand shoals, Deppes shoals, Catfish shoals, Baker shoals, and Bocks bar. The boating channel was cleared of snags and wreck heaps, and all overhanging trees were trimmed or felled. Attention is invited to the accompanying report of Mr. DeWitt upon the operations of the past season.

The work on this river is undoubtedly of a good deal of benefit to navigation, and should be provided for in future as it has been in the past.

The river and harbor act of March 3, 1905, appropriated the sum of $15,000 for continuing improvement of the river. A project has been approved providing for the expenditure of this money along the lines heretofore followed. The operations for the present season will not begin until the subsidence of high water.

Money statement.

July 1, 1904, balance unexpended	$1,914.06
Amount appropriated by river and harbor act approved March 3, 1905	15,000.00
	16,914.06
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	1,910.07
July 1, 1905, balance unexpended	15,003.99
July 1, 1905, outstanding liabilities	812.02
July 1, 1905, balance available	14,191.97
Amount (estimated) required for completion of existing project	Indefinite.

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APPROPRIATIONS AND ALLOTMENTS.

June 14, 1880	$5,000	June 3, 1896	$5,000
March 3, 1881	10,000	March 3, 1899	15,000
August 2, 1882	10,000	June 13, 1902	10,000
July 5, 1884	5,000	Allotted by Secretary of War from act of June 13, 1902	1,000
August 5, 1886	7,500	March 3, 1905	15,000
August 11, 1888	5,000	Total	101,500
September 19, 1890	4,000		
July 13, 1892	4,000		
August 18, 1894	5,000		

COMMERCIAL STATISTICS, GASCONADE RIVER.

The steamboat traffic was carried on by the steamers *Henry Wohlt* and *Buck Elk*.

TABLE 1.—*Close approximation to the amount of river trade during 1904.*

Class.	Grain.	Live stock.	Lumber and wood.	Railroad ties.	Building material.	General merchandise, farm machinery, etc.	Total.	Mile-tons.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	
Packets	1,896	227	724	1,956	93	842	5,738	226,247
Rafts				9,053			9,053	664,680
Total	1,896	227	724	11,009	93	842	14,791	890,927

Passengers carried, 85.

TABLE 2.—*Comparative statement of the commerce of the river, expressed in tons, from 1904 to 1897.*

Shipments.	1904.	1903.	1902.	1901.	1900.	1899.	1898.	1897.
Grain and hay	1,896	196	4,446	2,437	4,796	2,100	1,667	1,467
Live stock	227	15	167	485	255	414	708	686
Lumber, wood, and railroad ties	11,733	10,551	28,305	14,869	15,504	19,864	27,134	27,614
Building material	93	2	9,845	418	166	6	320	69
General merchandise, farm machinery, etc	842	24	1,617	1,251	859	1,875	1,152	679
Total	14,791	10,788	44,380	19,460	21,580	24,259	30,981	30,515

TABLE 3.—*Comparative commerce of the river, expressed in mile-tons, during the years 1904 to 1897.*

Class.	1904.	1903.	1902.	1901.	1900.	1899.	1898.	1897.
Packets	226,247	9,189	1,231,183	369,223	236,992	307,376	162,594	179,777
Rafts	664,680	691,500	2,508,270	1,347,300	1,187,280	1,079,753	1,669,669	2,030,125
Total	890,927	700,639	3,739,453	1,716,523	1,424,272	1,387,129	1,832,263	2,209,902

REPORT OF MR. W. R. DE WITT, UNITED STATES ASSISTANT ENGINEER.

SIOUX CITY, IOWA, *June 30, 1905.*

MAJOR: I have the honor to submit the following report of operations on the Gasconade River for the fiscal year ending June 30, 1905:

The project for the improvement of this stream, adopted in 1880, contemplated the removal of snags from the channel and of overhanging trees from caving banks

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and the construction of wing dams and training walls to concentrate the flow of water upon the shoals to increase the depth at those places. This general project was adhered to during the past fiscal year. The work was carried on from funds derived from the following sources:

Available cash on hand July 1, 1905	$914.06
Allotted from emergency river and harbor act of June 13, 1902	1,000.00
Total available cash July 1, 1904	1,914.06

An examination of all the works between Cooper Hill and the mouth of the river was made between the dates of August 28 and 30, 1904, and a report with project for the season's work was submitted to you under date of August 31, 1904, which received your approval dated September 6, 1904. Preparations were immediately begun for active operations.

The project submitted included repairs and extensions to existing works and the removal of snags and overhanging trees.

The working plant consisted of one barge outfitted with boiler, hoist, sheer legs, and tackle for pulling snags, one chartered barge for hauling construction materials and one small office boat. This outfit was towed from Gasconade to Cooper Hill by the chartered steamer *Henry Wohlt* between the dates of September 19 and 22, 1904. Arriving at Cooper Hill on the latter date, the steamer was discharged and active operations commenced, working downstream, the plant to be dropped by hand from place to place, as the work progressed. Active operations were carried on until December 1, 1904, when the plant arrived at the boat and supply yard at Gasconade, Mo., was laid up for the winter and the force discharged. The work accomplished was as follows:

Sand shoals.—A breach of 30 feet in the existing dam was closed with cribwork.

Catfish shoals.—A breach of 60 feet in the existing dam was closed with cribwork and the shore end strengthened by the construction of a brush and rock dike 50 feet long and 20 feet wide.

Baker's shoals.—Six hundred feet of dam was raised in height 12 inches to restore it to grade.

Bock's bar.—Two breaches in the existing dam, one 60 feet and one 40 feet long, were closed with cribwork.

The only work done under the allotment of $15,000 appropriated by act of Congress March 3, 1905, was the partial construction of two new barges for use in the coming season's work.

The expenditures for the year were as follows:

Administration		$70.00
Care of and repairs to plant		329.93
Stationery, etc		6.65
Transportation		1.15
Snagging and cutting overhanging trees		494.85
Towage		139.94
Expenditure at—		
Sand shoals		196.83
Deppe's shoals		35.27
Catfish shoals		168.77
Baker's shoals		227.75
Bock's bar		62.98
Construction of new barges, labor		709.17
Total		2,443.29
Amount on hand July 1, 1905	$1,914.06	
Appropriated by act of Congress March 3, 1905	15,000.00	
		16,914.06
Balance available July 1, 1905		14,470.77

Respectfully submitted.

W. R. DE WITT,
Assistant Engineer.

Maj. H. M. CHITTENDEN,
Corps of Engineers.

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A A 4.

ESTABLISHMENT AND MODIFICATION OF HARBOR LINES IN MISSOURI AND KANSAS RIVERS AT KANSAS CITY, MISSOURI AND KANSAS.

UNION DEPOT, BRIDGE AND
TERMINAL RAILROAD COMPANY,
Kansas City, Mo., March 4, 1903.

DEAR SIR: The interests invested in the properties officially represented by me as president of the several corporations, own substantially over 3,000 acres of land in Clay County, Mo., also about 200 acres of land in Jackson County, Mo., of which the water line of these properties on the north shore or Clay County side is 40,400 feet or 7.65 miles, on the water line on south shore or Jackson County side is 7,600 feet or 1.44 miles.

It is our purpose, with the official consent or approval of your honorable self, to construct a protection dike of permanent and solid work, similar to the character of work we are now engaged on, along the south shore, in order to afford protection from overflow and resultant damages to our property, therefore our petition, briefly stated is, the establishment of a harbor line along the north shore of Missouri River, from the east end of a Government revetment work, about 1¼ miles westerly from the west end of Grand Island, to a point about 875 feet east of center line of Chicago, Milwaukee and St. Paul Railroad Company's bridge.

The accompanying map[a] shows the line referred to above. This suggestive line as shown on map seems to be consistent and conservative, relative to former shore lines, and the established harbor line on south shore.

* * * * * * *

We respectfully request action be taken as early as may be practicable, and trust the suggested harbor line along the north shore, as designated by us, will meet with full approval. Awaiting advice.

Very respectfully, yours,

GEO. H. ROSS,
President.

Hon. ELIHU ROOT,
Secretary of War.

LETTER OF REPRESENTATIVES J. D. BOWERSOCK, W. S. COWHERD, AND JOHN DOUGHERTY.

HOUSE OF REPRESENTATIVES,
Washington, November 11, 1903.

SIR: A Board of Engineers has been appointed to consider the question of harbor lines at Kansas City. The greatest difficulty in fixing harbor lines at Kansas City and in maintaining the condition of the river along the city front arises from the fact of its being so near the mouth of the Kansas River.

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[a] Not printed.

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We respectfully suggest that this Board in considering the fixing of harbor lines at Kansas City be requested to take into consideration the condition of the river from Quindaro to the mouth of the Big Blue, and likewise the condition of the Kansas River at and near its mouth.

This is the earnest wish of the citizens of both Kansas City, Mo., and Kansas City, Kans., as evidenced by the petition[a] we inclose herewith.

Yours respectfully,

J. D. BOWERSOCK.
W. S. COWHERD.
JOHN DOUGHERTY.

The SECRETARY OF WAR.

[First indorsement.]

WAR DEPARTMENT,
November 11, 1903.

Respectfully referred to the Chief of Engineers for reference to the Kansas City Harbor Line Board, to be included in their consideration in fixing the harbor line.

By direction of the Secretary of War:

M. O. CHANCE,
Private Secretary.

[Second indorsement.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, November 12, 1903.

Respectfully referred to Col. Amos Stickney, Corps of Engineers, for consideration and report by the Board of Engineers, constituted by paragraph 2 of Special Orders, No. 39, Office Chief of Engineers, October 31, 1903. It is desired that the Board's report shall specifically cover the points presented in the within letter and the accompanying papers.

To be returned.

By order of the Acting Chief of Engineers:

H. F. HODGES,
Major, Corps of Engineers.

[Third indorsement.]

U. S. ENGINEER OFFICE, ARMY BUILDING,
New York, February 4, 1904.

Respectfully returned to the Chief of Engineers, United States Army, with report of Board of Engineers, dated January 23, 1904.

AMOS STICKNEY,
Colonel, Corps of Engineers.

LETTER OF THE CHIEF OF ENGINEERS, UNITED STATES ARMY.

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, August 19, 1904.

In March, 1903, at the request of the Union Depot, Bridge and Terminal Railroad Company, the Department undertook the consideration of the establishment of harbor lines on the Missouri River at a

[a] Not printed.

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point near Kansas City; and at the request of Congressmen Bowersock, Cowherd, and Dougherty, the Secretary of War directed on November 11, 1903, that the Board of Engineers, having the matter in charge, also take into consideration the condition of the Missouri River from Quindaro to the mouth of the Big Blue River, and of the Kansas River at and near its mouth.

Over a portion of the Missouri River included within the limits named, and on the Kansas River at its mouth, harbor lines had already been established by the Secretary of War.

The attention of the Secretary of War is respectfully invited to the report of the Board of Engineers dated January 23, 1904, herewith, from which it appears that in connection with its investigations special surveys have been made and a public hearing held. The harbor lines, as finally determined upon and recommended by the Board, are, therefore, the result of careful deliberation, full opportunity to be heard having been given all interested parties. The lines presented extend over the entire reach of the Missouri River from Quindaro to the mouth of the Big Blue River, and for but a very short distance on the Kansas River at its mouth. For the reasons given the Board did not recommend the establishment of further lines on the Kansas River at this time.

The lines adopted by the Board are in part new lines, in part the existing lines, and in part a modification of the present lines. The variations from the former lines are in every case advances beyond them.

Concurring in the views of the Board, I recommend that the harbor lines, delineated on the accompanying tracing[a] and described in a separate paper, be approved by the Secretary of War, and further that the Secretary place his approval on the tracing and description, both of which have been prepared for his signature.

Very respectfully,

A. MACKENZIE,
Brig. Gen., Chief of Engineers, U. S. Army.

Hon. WM. H. TAFT,
Secretary of War.

REPORT OF THE BOARD OF ENGINEERS.

JANUARY 23, 1904.

GENERAL: The Board of Engineers constituted by Special Orders, No. 39, Office Chief of Engineers, Washington, October 31, 1903, has the honor to make the following report upon the subject of harbor lines at Kansas City:

By instructions from the office of the Chief of Engineers, dated November 12, 1903, the Board is required to take into consideration the Missouri River from Quindaro to the mouth of the Big Blue and the Kansas River at and near its mouth.

The Board met pursuant to a call of the senior member at 11 a. m., November 23, 1903, at the city hall in Kansas City, Mo. A public hearing was held between 2 and 5 p. m. of the same day. In the fore-

[a] Not printed.

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noon of November 24 the Board traversed by steamboat the entire length of the Missouri River embraced within the proposed harbor lines, and in the afternoon examined the Kaw River at several points within the limits of Kansas City, Kans.

Additional surveys being necessary before the proper location of the harbor lines could be finally determined, the Board ordered these surveys and adjourned until they could be completed. Pursuant to Special Orders, No. 49, Office Chief of Engineers, December 11, 1903, the Board reconvened in Kansas City, upon the call of the senior member, at 8 p. m., December 28, and finished its consideration of the subject of harbor lines on the following day.

HARBOR LINES FOR THE MISSOURI RIVER.

The harbor lines recommended by the Board for the Missouri River in the vicinity of Kansas City are shown on the accompanying maps.[a] A width of 1,100 feet has been adopted for that portion of the river above the bend at the mouth of the Kaw. Around this bend the width is increased somewhat, the maximum being 1,800 feet. This considerable increase is due in part to the direction of the flow from the Kaw, which, in high water, shoots diagonally across the Missouri, striking the northern shore. It is therefore important to withdraw this shore somewhat and provide a greater distance in which the current may expend itself and conform to the direction of flow in the Missouri.

Below the bend at the mouth of the Kaw a width of 1,200 feet has been adopted, except at the bends immediately above the Chicago, Milwaukee and St. Paul bridge, where it is increased to 1,500 feet to facilitate the high water flow around these bends, and to fix a point beyond which the railroad can not carry the embankment of its bridge approach toward the river.

The harbor line on the left bank below the Milwaukee bridge is terminated about a mile above the mouth of the Big Blue on account of the present unstable condition of the channel in that vicinity and the probability that radical changes will take place before any works are likely to be built to fix the bank of the river at the harbor line.

A portion of the line on the right bank covers the same stretch of river as that included in the harbor line established in 1901, and coincides with it a part of the distance. The variations from the former line are in every case advances beyond it.

The lines, as recommended, are the result of careful investigation and a full opportunity for all parties interested to be heard.

KAW RIVER HARBOR LINES.

The Kaw River flows through the business portion of the two Kansas Citys, and it is important, for the proper control and regulation of the stream in the matter of encroachments, bridges, and other obstructions, that harbor lines be established along its shores. The stream is a navigable one within the meaning of the Federal statutes and the right of the Government to establish harbor lines would seem to be unquestionable. Nevertheless, the Board does not consider it advisable to do this until it is decided what action, if any, will be taken in

[a] Not printed.

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regard to the improvement of the stream for the purposes of navigation and flood prevention. Any adequate solution of the flood problem will require a considerable widening of the present channel and some changes of location. Harbor lines established along the present banks would therefore have to be changed. For this reason it is recommended that the establishment of such lines be deferred for the present. In this connection the Board invites attention to its report of this date upon flood conditions at and near the mouth of the Kaw River.

Accompanying this report are the following papers:

Map [a] showing details of harbor lines.

Tabulated description of reference points for the purpose of locating lines on ground.

Minutes [a] of a public hearing and copies of all papers [a] presented to the Board bearing on the subject of harbor lines. (See list, [a] next page.)

Respectfully submitted.

AMOS STICKNEY,
Colonel, Corps of Engineers.
J. G. WARREN,
Major, Corps of Engineers.
H. M. CHITTENDEN,
Captain, Corps of Engineers.

Brig. Gen. ALEXANDER MACKENZIE,
Chief of Engineers, U. S. A.

DESCRIPTION OF KANSAS CITY HARBOR LINES.

[In three tables.]

TABLE I.—*Description of proposed harbor lines along both banks of Missouri River in the vicinity of Kansas City, Mo., and Kansas City, Kans.*

In general, single capital letters are used to denote points on the right-bank line and double capitals points on left-bank line.

All distances are given in feet.

The coordinates and azimuths given in these tables are referred to rectangular axes, the axes being a meridian and a tangent to the parallel through a mark of survey of 1893 on tile roof of northeast corner of New York Life Insurance Building. The south point is taken as zero for azimuths, and is determined from the base △ "N. Y. L." and secondary △ "Kansas City" of the Missouri River Commission. See Tables I, II, and III for further description. Southerly and westerly latitudes and departures are considered as positive, and northerly and easterly latitudes and departures as negative.

From—	To—	Azimuth.	Distance.	Description.
		° ′ ″		
A	B			Circular curve to left on harbor line. Radius, 11,650 feet. Central angle, 15° 30′. Azimuths of radii through beginning and end of curve, 4° 24′ and 348° 54′.
B	C	258 54 00	2,610.0	Tangent on harbor line.
C	D			Circular curve to left on harbor line. Radius, 18,524.1 feet. Central angle, 9° 18′. Azimuths of radii through beginning and end of curve, 348° 54′ and 339° 36′.
D	E			Circular curve to right on harbor line. Radius, 8,998.8 feet. Central angle, 43° 20′. Azimuths of radii through beginning and end of curve, 339° 36′ and 22° 56′.

[a] Not printed.

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TABLE I.—*Description of proposed harbor lines along both banks of Missouri River in the vicinity of Kansas City, Mo., and Kansas City, Kans.*—Continued.

From—	To—	Azimuth.	Distance.	Description.
		° ′ ″		
E	F			Circular curve to right on harbor line. Radius, 2,350 feet. Central angle, 68°. Azimuths of radii through beginning and end of curve, 202° 56′ and 270° 56′.
F	G			Circular curve to right on harbor line. Radius, 11,904.1 feet. Central angle, 12° 53′ 40″. Azimuths of radii through beginning and end of curve, 270° 56′ and 283° 49′ 40″.
G	H[a]	13 49 40	1,100.0	Tangent on harbor line.
H	I			Circular curve to right on harbor line. Radius, 2,380 feet. Central angle, 30° 48′ 20″. Azimuths of radii through beginning and end of curve, 283° 49′ 40″ and 314° 38′.
I	J[a]	44 38 00	4,460.6	Tangent on harbor line.
J	K			Circular curve to left on harbor line. Radius, 4,093.3 feet. Central angle, 39°. Azimuths of radii through beginning and end of curve, 134° 38′ and 95° 38′.
K	K_1			Circular curve to left. Radius, 4,093.3 feet. Central angle, 49° 33′. Azimuths of radii through beginning and end of curve, 95° 38′ and 46° 05′. This portion of curve is not a part of harbor line, being covered by the mouth of the Kaw River. For description of connecting lines extending up mouth of Kaw, see page 1715 to 1719, inclusive, of this table. The Kaw lines are the same as those established August 7, 1901, and the points are denoted by the letters G_1, H_1, J_1, L_1, M_1, and N_1, which are the same as G, H, J, L, M, and N in the description of 1901.
K_1	L			Circular curve to left on harbor line. Radius, 3,375 feet. Central angle, 75° 06′ 45″. Azimuths of radii through beginning and end of curve, 46° 05′ and 330° 58′ 15″.
⊙53	K_1	238 33 00	607.1	K_1 is a point on harbor line.
⊙85	N	165 22 15	32.2	N is a point on harbor line.
N	L	60 58 15	4,527.1	Part of tangent on harbor line.
⊙61	M	165 41 00	92.1	M is a point on harbor line.
M	L	60 58 15	2,416.0	Part of tangent on harbor line.
L	O	240 58 15	13,580.0	Tangent on harbor line.
⊙43	O	158 37 20	590.6	O is a point on harbor line.
O	R			Circular curve to left on harbor line. Radius, 6,980 feet. Central angle, 42° 57′. Azimuths of radii through beginning and end of curve, 330° 58′ 15″ and 288° 01′ 15″.
R	S			Circular curve to right on harbor line. Radius, 2,578.5 feet. Central angle, 51° 54′ 45″. Azimuths of radii through beginning and end of curve, 108° 01′ 15″ and 159° 56′.
⊙93	R	127 00 00	2,514.5	R is a point on harbor line.
⊙98	S	172 00 20	3,169.0	S is a point on harbor line.
S	T	249 56 00	4,061.2	Tangent on harbor line.
T	U			Circular curve to right on harbor line. Radius, 5,870.7 feet. Central angle, 17° 56′. Azimuths of radii through beginning and end of curve, 159° 56′ and 177° 52′.
U	V			Circular curve to right on harbor line. Radius, 12,044.4 feet. Central angle, 17° 16′. Azimuths of radii through beginning and end of curve, 177° 52′ and 195° 08′.
V	W			Circular curve to right on harbor line. Radius, 6,659.8 feet. Central angle, 40° 28′. Azimuths of radii through beginning and end of curve, 195° 08′ and 235° 36′.
W	X			Circular curve to right on harbor line. Radius, 3,800 feet. Central angle, 28° 30′. Azimuths of radii through beginning and end of curve, 235° 36′ and 264° 06′.
X	Y	354 06 00	2,670.0	Tangent on harbor line.
Y	Z[b]			Circular curve to left on harbor line. Radius, 6,430 feet. Central angle, 20°. Azimuths of radii through beginning and end of curve, 84° 06′ and 64° 06′.
AA	BB			Circular curve to left on harbor line. Radius, 10,550 feet. Central angle, 15° 30′. Azimuths of radii through beginning and end of curve, 4° 24′ and 348° 54′.
BB	CC	258 54 00	2,610.0	Tangent on harbor line.
CC	DD			Circular curve to left on harbor line. Radius, 12,424.1 feet. Central angle, 9° 18′. Azimuths of radii through beginning and end of curve, 348° 54′ and 339° 36′.
DD	EE			Circular curve to right on harbor line. Radius 10,098.8 feet. Central angle, 43° 20′. Azimuths of radii through beginning and end of curve, 339° 36′ and 22° 56′.
△28	EE	302 35 00	960.5	
EE	FF			Circular curve to right on harbor line. Radius, 3,450 feet. Central angle, 68°. Azimuths of radii through beginning and end of curve, 202° 56′ and 270° 56′.

[a] From A to a point opposite JJ the perpendicular distance between right and left harbor lines is 1,100 feet.

[b] Point Z is the lower end of proposed right-bank harbor line, near mouth of Big Blue River.

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TABLE I.—*Description of proposed harbor lines along both banks of Missouri River in the vicinity of Kansas City, Mo., and Kansas City, Kans.*—Continued.

From—	To—	Azimuth.	Distance.	Description.
		° ′ ″		
⊙94.....	FF....	172 29 00	462.0	FF is a point on harbor line.
FF	GG ...	.....	.....	Circular curve to right on harbor line. Radius, 13,004.1 feet. Central angle, 12° 53′ 40″. Azimuths of radii through beginning and end of curve, 270° 56′ and 283° 49′ 40″.
GG	△24...	13 49 40	1,100.0	Tangent on harbor line.
⊙42.....	△24...	97 58 00	674.0	△24 is a point on harbor line.
△24.....	II.....	.....	.....	Circular curve to right on harbor line. Radius, 3,480 feet. Central angle, 30° 48′ 20″. Azimuths of radii through beginning and end of curve, 283° 49′ 40″ and 314° 38′.
△22.....	II.....	204 39 00	925.4	II is a point on harbor line.
II.....	JJ	44 38 00	4,044.0	Tangent on harbor line.
△20.....	JJ	176 00 00	1,376.6	JJ is a point on harbor line.
JJ	LL[a] ..	.....	.....	Circular curve to left on harbor line. Radius, 2,729.4 feet. Central angle, 163° 39′ 45″. Azimuths of radii through beginning and end of curve, 134° 38′ and 330° 58′ 15″.
⊙61.....	LL....	104 10 00	1,882.6	LL is a point on harbor line.
LL	OO ...	240 58 15	10,610.3	Tangent on harbor line.
⊙45	OO ...	141 37 00	1,801.0	OO is a point on harbor line.
OO	QQ[b] ..	.....	.....	Circular curve to left on harbor line. Radius, 11,644.1 feet. Central angle, 17° 57′. Azimuths of radii through beginning and end of curve 330° 58′ 15″ and 318° 01′ 15″.
QQ	RR ...	.....	.....	Circular curve to left on harbor line. Radius, 5,480 feet. Central angle, 25°. Azimuths of radii through beginning and end of curve 313° 01′ 15″ and 288° 01′ 15″.
RR	SS	.....	.....	Circular curve to right on harbor line. Radius, 4,078.5 feet. Central angle, 51° 54′ 45″. Azimuths of radii through beginning and end of curve 108° 01′ 15″ and 159° 56′.
△16.....	SS	89 51 00	178.1	SS is a point on harbor line.
SS	TT....	249 56 00	2,160.0	Tangent on harbor line.
TT.....	VV ...	.....	.....	Circular curve to right on harbor line. Radius, 13,244.4 feet. Central angle, 35° 12′. Azimuths of radii through beginning and end of curve 159° 56′ and 195° 08′.
VV	△46[c] .	.....	.....	Circular curve to right on harbor line. Radius, 7,859.3 feet. Central angle, 40° 28′. Azimuths of radii through beginning and end of curve 195° 08′ and 235° 36′.

[a] From LL to OO the perpendicular distance between the right and left harbor lines is 1,200 feet.
[b] From QQ to TT the perpendicular distance between harbor lines is 1,500 feet.
[c] △46 is the lower end of proposed harbor line on left bank. From a point opposite U to △46 the perpendicular distance between harbor lines is 1,200 feet.

DESCRIPTION OF POINTS G_1 TO N_1, INCLUSIVE, AND REFERENCE POINTS FOR THE SAME.

Points G_1, H_1, J_1, L_1, M_1, and N_1 are the same as points G, H, J, L, M, and N, on harbor line approved August 7, 1901, from the description of which the following is taken:

b. Point in prolongation of line 34 feet south of and parallel to the north line of Washington avenue. Bears north 89° 55′ east, 652 feet from center line of Third street, Kansas City, Kans.

d. Point in the prolongation of a line 20 feet north of and parallel to the center line of Ohio avenue and 450 feet northeasterly from the center line of James street, Kansas City, Kans.

e. Boundary monument on line between Missouri and Kansas, 19.6 feet south of arrow mark on the brick wall of the office of the Armour Packing Company; also 638.4 feet north of a point 125 feet south of the south line of Ninth street.

G_1. Kaw River, north line. Point of beginning of tangent. Bears south 50° 52′ east, 675 feet distant from point b. Gas pipe stands 1 foot northeasterly of this point.

H_1. Kaw River, north line. Point at end of line and of tangent, about 8 feet northeasterly of east cylinder of north pier of Missouri Pacific Railroad bridge across Kaw River. Point bears south 34° 22′ west, 1,415 feet from point G_1.

J_1. Marked by gas pipe (one-half inch) which stands in dike about 25 feet from outer end on south bank of Kaw River. Line begins at this point, which bears north 53° 10′ east, 915 feet from east cylinder of south pier of Missouri Pacific Railroad bridge across Kaw River. The distance is measured from face of pier, not from center.

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L_1. Kaw River, south line. Point bears north 18° 45′ east, 1,855 feet distant from point d.

M_1. Bears north 36° 15′ east, 1,762 feet distant from point d.

N_1. Point of intersection of State line between Missouri and Kansas, 2,360 feet north of boundary monument referred to as point e.

Description of harbor lines at the mouth of the Kaw River.

From—	To—	Azimuth.	Distance.	Description.
		° ′		
K	G_1			Circular curve to right on harbor line. Radius, 3,050 feet.
G_1	H_1	S. 34 22 W.	1,415	
J_1	L_1			Circular curve to right on harbor line. Radius, 1,200 feet.
L_1	M_1			Do.
M_1	N_1			Circular curve to left on harbor line. Radius, 4,100 feet.
N_1	K_1			Do.

TABLE II.—*Coordinates and description of points.*

Point.	Latitude.	Departure.	Description of point.
△N. Y. L.	0	0	Cross mark on tile roof near northeast corner of New York Life Insurance building, at a distance of 2.7 feet from *inside of north* wall. Wall is 20 inches thick.
△K. C	− 4,294.3	− 9,119.5	Secondary △ Missouri River Commission.
△6	− 6,984.2	− 4,126.3	Gas pipe, 1¼ inches in diameter and about 42 inches long. Same description applies to all points marked by gas pipe.
△5	− 3,304.2	− 4,004.5	Gas pipe near east line of Troost avenue, a short distance south of Second street.
△7	− 6,515.1	− 6,573.8	Gas pipe about 12 feet south of south track of Kansas City Suburban Belt R. R.
△8	− 8,019.8	− 5,734.6	Gas pipe, on old levee.
△9	− 7,671.7	− 8,399.0	Gas pipe.
△10	− 8,845.1	− 7,634.8	Do.
△11	− 8,751.1	−10,204.1	Do.
△12	−10,120.6	− 9,211.8	Do.
△13	−10,612.9	−12,506.8	Do.
△14	−12,512.9	−10,636.7	Do.
△15	−13,545.3	−14,710.8	Gas pipe 2,357.8 feet southerly from center of north shore pier of Milwaukee bridge along center line of bridge and 152.6 feet westerly at right angles to center line of bridge.
△16	−15,791.1	−13,983.2	Gas pipe on center line of north shore pier of Milwaukee bridge and 20 feet westerly from center line of bridge.
△39	−15,386.6	−17,136.9	
△40	−17,252.3	−16,400.0	
△41	−15,488.4	−19,998.6	
△42	−18,571.8	−21,217.2	
△43	−14,172.1	−23,276.9	
△44	−16,600.2	−25,370.4	
△45	−12,486.3	−25,375.5	
△46	−13,593.7	−28,333.1	
△47	− 8,578.4	−26,851.8	
△48	− 8,911.5	−29,514.6	
△49	− 3,942.9	−28,617.4	
△50	− 6,601.8	−30,452.5	
△51	− 4,129.9	−33,691.5	
△52	− 6,178.4	−32,715.3	
△53	− 5,766.6	−35,397.8	
△54	− 7,205.0	−33,908.0	
△55	− 6,643.2	−37,051.2	
△56	− 9,380.5	−35,000.2	
△4	− 5,436.0	− 1,231.0	Gas pipe on bank 299 feet below lower end of north shore pier of Winner bridge.
△3	− 3,044.6	− 1,428.5	Gas pipe.
△2	− 4,687.2	+ 1,733.7	Gas pipe about 8 feet east of center of Hannibal bridge and 7 feet south of end of north trestle approach. Top of pipe about 3½ feet below rail.
△1	− 2,655.0	+ 1,056.9	=P. B. M. 230 (=?? on river bank below Hannibal bridge).
△18	− 4,520.4	+ 3,962.7	Gas pipe.
△17	− 1,278.4	+ 5,516.5	Do.
△19	− 4,789.0	+ 7,583.1	Do.
△20	− 6,586.1	+ 5,125.3	Do.
△21	− 8,953.6	+ 5,705.2	Do.
△22	− 9,996.3	+ 2,766.3	Do.
△23	−10,355.9	+ 4,889.2	Do.
△24	−12,450.8	+ 1,477.9	Do.
△25	−12,870.9	+ 4,482.6	Do.
△26	−17,464.8	+ 962.2	Do.

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TABLE II.—*Coordinates and description of points*—Continued.

Point.	Latitude.	Departure.	Description of point.
△28	−20,165.8	+ 3,754.6	Gas pipe 8 feet southerly from center of Kansas City, St. Joseph and Council Bluffs R. R., approximately 1,398 feet east of county line between Platte and Clay counties, and 2,360 feet east of milepost 5.
△27	−17,582.0	+ 5,825.7	Gas pipe.
△29	−18,970.1	+ 8,988.7	Do.
△30	−21,472.7	+ 6,645.2	Gas pipe, 8 feet southerly from center of Kansas City, St. Joseph and Council Bluffs R. R., and approximately 812 feet west of milepost 5.
△29	−18,970.1	+ 8,988.7	
△30	−21,472.7	+ 6,645.2	
△30a	−21,216.6	+ 6,885.0	
△31	−18,523.3	+10,819.2	
△32	−20,555.7	+10,000.0	
△32a	−20,097.5	+11,574.2	
△33	−17,822.3	+14,318.2	
△34	−19,289.8	+13,709.7	
△34a	−18,796.3	+15,495.6	
△35	−17,450.1	+18,536.5	
△36	−18,851.5	+17,506.2	
△37	−17,907.3	+19,630.0	
△38	−18,812.5	+19,237.0	
△38a	−19,530.9	+20,905.8	
⊙31	− 1,489.3	+ 2,257.5	Gas pipe, 2.4 feet northerly from center of north end of west pier of Kansas City Southern bridge over tracks near foot of Fourth street, Kansas City, Mo.
⊙32	−19,359.8	+ 1,971.9	Gas pipe, 8.8 feet from center of railroad track and in line with △30 and △28, at end of curve west of milepost 4.
⊙33	−10,141.7	−12,152.7	Gas pipe.
⊙34	−20,773.9	+ 1,633.7	Gas pipe. See sketch on map[a] for description.
⊙35			Gas pipe.
⊙36	−17,456.9	+ 767.6	Gas pipe, 7.5 feet westerly from center of Kansas City, St. Joseph and Connell Bluffs R. R., at south end of curve south of milepost 4.
⊙37	− 8,632.5	−10,514.5	Gas pipe, at intersection of center line of double track Kansas City Suburban Belt R. R. and the east and west center line of sec. 27, T. 50, R. 33 W.
⊙38	−15,957.0	+ 779.5	
⊙39	− 8,944.1	−10,526.8	Gas pipe, in line with △9 and △11.
⊙40			Gas pipe, 7.5 feet west of center of railroad.
⊙41	− 8,308.1	−10,036.9	Gas pipe, center line of double track Kansas City Suburban Belt R. R.
⊙42	−12,357.7	+ 811.0	Gas pipe, 7.5 feet west of center of railroad.
⊙43	− 8,126.7	− 9,781.2	Gas pipe, at intersection of tangents of double track Kansas City Suburban Belt R. R. at north edge of north rail of south track, on curve east of Elmdale Station.
⊙44			Gas pipe, in line with △22 and △24 and 600 feet from △22.
⊙45	− 7,391.9	− 8,440.5	Gas pipe, on center line double track Kansas City Suburban Belt R. R.
⊙46	− 9,173.0	+ 3,335.0	Gas pipe.
⊙47	− 7,327.1	+ 8,569.9	Gas pipe, center line of Virginia avenue and 580.8 feet east of intersection of Third and Virginia.
⊙48	− 8,185.0	+ 4,018.0	Gas pipe.
⊙49	− 4,191.7	+ 9,091.7	Gas pipe, 25 feet north of center of Minnesota avenue and 54.8 feet east of center of Third street.
⊙50	− 7,526.0	+ 4,473.0	Gas pipe.
⊙51	− 2,020.5	+ 7,558.2	Do.
⊙52	− 6,411.9	+ 5,027.3	Do.
⊙53	− 2,404.5	+ 6,851.2	Do.
⊙54	− 5,462.9	+ 5,508.1	Do.
⊙55			Point on center line of James street not marked.
⊙56	− 4,846.8	+ 4,763.8	Gas pipe.
⊙57	− 2,755.2	+ 8,328.0	Do.
⊙58	− 3,734.7	+ 2,738.8	Gas pipe, on line with △18 and △1.
⊙50	− 7,526.0	+ 4,473.0	Gas pipe.
⊙51	− 2,020.5	+ 7,558.2	Do.
⊙52	− 6,411.9	+ 5,027.3	Do.
⊙53	− 2,404.5	+ 6,851.2	Do.
⊙54	− 5,462.9	+ 5,508.1	Do.
⊙56			Point on center line James street, not marked.
⊙56	− 4,846.8	+ 4,763.8	Gas pipe.
⊙57	− 2,755.2	+ 8,328.0	Do.
⊙58	− 3,734.7	+ 2,738.8	Gas pipe, on line with △18 and △1.
⊙59	− 897.8	+ 4,479.6	Gas pipe, 10 feet west of center line of Mulberry street and 532.7 feet north of center of West Eighth street.
⊙61	− 3,194.5	+ 129.4	Gas pipe, 15 feet east of center line of Main street and 1,100 feet north of north line of Third street.
⊙63	− 7,179.9	− 7,989.0	Gas pipe, about 7 feet south of south track of Kansas City Suburban Belt R. R.

[a] Not printed.

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TABLE II.—*Coordinates and description of points*—Continued.

Point.	Latitude.	Departure.	Description of point.
⊙65	− 6,191.5	− 7,910.1	Gas pipe, 7.4 feet easterly from prolongation of center line of Park avenue, 1,169.2 feet northerly from center of Guinotte avenue. For fuller description see sketch on map.[a]
⊙67	− 5,062.2	− 8,212.8	Center line of Guinotte avenue, 7.4 feet easterly from center of Park avenue.
⊙69	.....	.....	Center of Guinotte avenue and on west line of Woodland avenue.
⊙71	− 4,400.3	− 5,787.6	Center of Guinotte avenue, 901 feet westerly from point 69 and about 16 feet west of east line of Alton avenue.
⊙73	.....	.....	Gas pipe.
⊙75	− 5,197.3	− 5,570.1	Gas pipe, center of north track Kansas City Suburban Belt R. R.
⊙81	− 7,313.1	− 7,108.9	East pile of present east end of outer row of piling Union Depot Bridge and Terminal R. R. Co.'s dike.
⊙85	− 4,276.7	− 1,702.1	Gas pipe, about 4 feet from top of filled bank on center line of Holmes street, 1,957.8 feet northerly from center line of Fourth street.
⊙89	−11,169.4	−13,167.5	Gas pipe.
⊙90	− 8,479.4	− 1,786.9	Not marked.
⊙92	−17,572.9	+ 766.6	Gas pipe.
⊙93	−11,107.2	−14,824.5	Northeast corner sec. 27; marked by ¾-inch iron rod about 2 feet below present ground surface.
⊙94	−17,571.4	+ 619.8	Gas pipe, northwest corner of sec. 14, 139.3 feet east of produced tangent of Kansas City, St. Joseph and Council Bluffs R. R.
⊙95	− 8,465.9	−14,725.1	Stone at E. ¼ corner sec. 27, T. 50, R. 33 W.
⊙96	−17,543.5	− 1,918.0	Stone at N. ¼ corner sec. 14.
⊙97	− 8,569.5	−12,089.8	Not marked; on east and west center line sec. 27, 10 feet west of stone at center of section.
⊙98	−12,274.0	− 1,841.9	Stone at S. ¼ corner sec. 14.
⊙99	.....	.....	Gas pipe, 35 feet northerly from ⊙97.
⊙100	−12,292.5	− 522.2	Stone at S. ¼ corner of SW. ¼ sec. 14.
⊙101	.....	.....	Stone 12 inches square at intersection of west line of Park avenue and south line of Front street. See sketch on map.[a]
⊙102	−12,325.6	+ 797.4	Stone at SW. corner sec. 14, 4.9 feet east of center of Kansas City, St. Joseph and Council Bluffs R. R.
⊙104	−12,326.0	+ 809.8	Not marked. See description of transit lines.
⊙105	.....	.....	Center line of Holmes and Fourth streets.
⊙107	.....	.....	South line of Front street and 15 feet east of center line of Main street.
⊙109	.....	.....	North line of Third street and 15 feet east of center line of Main street.
⊙111	.....	.....	Center of West Eighth street and 10 feet west of center of Mulberry street.
⊙113	.....	.....	Center of James street and center of that part of Ohio avenue southwest of James street.
⊙106	−20,787.5	+ 5,019.1	Not marked; 8 feet from center of railroad track and on line between Platte and Clay counties.
⊙108	−22,895.0	+ 4,989.1	Stone at NW. corner sec. 10, T. 50, R. 33.
A	−17,501.0	+17,825.5	
AA	−18,597.8	+17,741.1	
B	−17,684.6	+14,088.8	
BB	−18,764.1	+14,900.6	
C	−18,187.1	+12,127.6	
CC	−19,266.5	+12,339.4	
D	−18,782.2	+10,017.1	
DD	−19,813.2	+10,400.5	
E	−18,635.4	+ 3,373.9	
EE	−19,648.5	+ 2,945.3	
F	−16,433.0	+ 1,939.8	
FF	−16,415.0	+ 840.0	
G	−13,781.8	+ 2,283.2	
GG	−13,518.9	+ 1,215.1	
H	−12,713.7	+ 2,546.1	
I	−11,610.4	+ 3,163.5	
II	−10,837.6	+ 2,380.7	
J	− 8,436.2	+ 6,297.6	
JJ	− 7,959.4	+ 5,221.5	
K	− 5,962.2	+ 7,458.5	
K1	− 2,721.3	+ 6,333.3	
L	− 2,111.2	+ 2,264.4	
LL	− 3,656.3	+ 1,954.8	
M	− 3,238.7	+ 152.0	
N	− 4,307.9	− 1,694.0	
O	− 8,676.7	− 9,565.9	
OO	− 8,804.0	− 7,322.5	
QQ	−11,041.0	−10,185.3	

[a] Not printed.

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TABLE II.—*Coordinates and description of points*—Continued.

Point.	Latitude.	Departure.	Description of point.
R	−12,620.5	−12,816.4	
RR	−13,084.5	−11,390.0	
S	−14,245.4	−14,383.8	
SS	−15,654.4	−13,869.1	
T	−15,638.8	−18,198.5	
TT	−16,395.5	−15,898.0	
U	−15,991.1	−19,994.3	
V	−15,581.8	−23,587.0	
VV	−16,740.0	−23,900.0	
W	−12,915.7	−27,343.2	
X	−11,159.4	−27,987.7	
Y	− 8,503.5	−28,262.2	
Z	− 6,355.9	−28,873.9	
△46	−13,593.7	−28,333.1	

TABLE III.—*Azimuths and distances.*

From—	To—	Azimuth.			Distance.	From—	To—	Azimuth.			Distance.
		°	′	″				°	′	″	
△N. Y. L	△K. C	244	47	05	10,080.0	△54	△56	206	45	51	2,436.5
△N. Y. L	△6	210	34	30	8,112.1	△54	△55	280	07	06	3,198.0
△K. C	△6	118	18	42	5,671.6	△53	△55	242	04	31	1,871.4
△K. C	△5	79	02	47	5,209.9	△55	△56	143	09	21	3,420.5
△6	△5	1	53	47	3,681.8	△5	△4	127	32	45	3,498.2
△6	△7	280	50	47	2,491.9	△6	△4	61	52	05	3,283.3
△5	△7	218	39	57	4,112.3	△5	△3	84	14	35	2,589.1
△6	△8	237	13	02	1,913.0	△4	△3	355	16	39	2,399.6
△7	△8	150	51	07	1,722.9	△3	△2	117	26	54	3,563.3
△8	△9	277	26	37	2,687.1	△4	△2	75	49	19	3,057.8
△7	△9	237	38	22	2,160.9	△4	△1	39	26	31	3,601.3
△7	△10	204	28	56	2,560.0	△2	△1	341	34	55	2,142.0
△9	△10	146	54	47	1,400.3	△1	△18	122	42	00	3,453.1
△10	△11	272	05	29	2,571.0	△2	△18	85	43	23	2,235.3
△9	△11	239	07	14	2,103.1	△1	△17	72	50	48	4,667.1
△9	△12	198	21	24	2,580.0	△18	△17	25	36	20	3,595.0
△11	△12	144	04	04	1,691.2	△17	△19	149	30	54	4,073.6
△12	△13	261	29	57	3,331.9	△18	△19	94	14	30	3,630.2
△11	△13	231	02	38	2,961.4	△19	△20	233	49	25	3,044.8
△11	△14	186	33	33	3,786.5	△18	△20	150	37	48	2,370.3
△13	△14	135	26	53	2,666.0	△19	△21	204	16	15	4,568.4
△14	△15	256	46	48	4,202.9	△20	△21	166	14	15	2,437.4
△13	△15	216	55	38	3,668.1	△21	△22	250	27	55	3,118.3
△14	△16	225	35	25	4,684.7	△20	△22	214	40	25	4,146.6
△15	△16	162	02	58	2,360.8	△20	△23	183	35	00	3,777.0
△16	△40	238	50	34	2,824.0	△22	△23	99	36	45	2,153.1
△16	△39	277	18	38	3,179.5	△23	△24	238	26	43	4,003.2
△15	△39	232	48	15	3,046.0	△22	△24	207	41	44	2,772.1
△39	△40	158	26	42	2,006.0	△22	△25	149	09	39	3,348.0
△40	△42	254	40	52	4,994.7	△24	△25	97	57	36	3,083.9
△40	△41	296	06	46	4,007.7	△25	△26	217	27	53	5,787.7
△39	△41	267	57	50	2,863.5	△24	△26	185	52	27	5,040.5
△41	△42	201	33	52	3,315.5	△25	△28	185	41	57	7,331.1
△42	△44	295	23	41	4,597.4	△26	△28	134	02	45	3,885.0
△42	△43	334	54	52	4,858.0	△26	△27	91	22	45	4,864.9
△41	△43	291	52	34	3,532.6	△28	△27	38	42	45	3,311.5
△43	△44	220	46	06	3,206.1	△27	△30	168	07	15	.....
△44	△46	315	25	16	4,221.0	△28	△30	114	19	45	3,172.3
△44	△45	359	55	46	4,113.9	△27	△29	113	43	04	.....
△43	△45	308	46	26	2,691.8	△30	△29	43	07	07	.....
△45	△46	249	28	26	3,158.1	△28	⊙32	294	19	45	1,966.5
△46	△48	345	50	16	4,828.9	⊙32	⊙36	327	38	20	2,251.6
△46	△47	16	27	16	5,229.5	⊙36	△26	92	19	20	194.8
△45	△47	339	18	16	4,177.5	△28	⊙106	114	19	45	1,387.7
△47	△48	262	52	06	2,683.5	⊙106	⊙108	180	47	45	2,157.7
△48	△50	337	53	56	2,492.9	⊙36	⊙38	0	28	20	1,500.0
△47	△50	298	45	51	4,107.5	⊙38	⊙40				1,800.0
△47	△49	339	08	56	4,960.4	⊙40	⊙42				1,800.6
△49	△50	214	36	41	3,230.7	⊙42	⊙104				30.5
△50	△52	280	43	16	2,303.0	⊙104	⊙102	271	23	20	12.4
△50	△51	307	21	01	4,074.5	⊙102	⊙100				1,320.0
△49	△51	267	53	21	5,077.5	⊙100	⊙98	270	48	20	1,319.8
△51	△52	154	28	01	2,264.7	⊙98	⊙96	180	49	40	5,270.0
△52	△54	229	01	21	1,578.1	⊙96	⊙94	90	38	00	2,538.0
△52	△53	278	37	11	2,713.1	⊙94	⊙92	90	38	00	146.8
△51	△53	226	11	21	2,364.5	⊙92	⊙36	0	28	20	116.0
△53	△54	133	53	41	2,074.3	△22	⊙44	207	41	44	600.0

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TABLE III.—*Azimuths and distances*—Continued.

From—	To—	Azimuth.			Distance.	From—	To—	Azimuth.			Distance.
		°	′	″				°	′	″	
⧋22	⊙46	34	40	25	1,000.0	△3	⊙85	192	31	15	1,262.2
⊙46	⊙48				1,200.0	△5	⊙85	112	53	55	2,499.3
⊙48	⊙50				800.0	⊙85	⊙105	345	22	15	1,957.8
⧋20	⊙52	330	37	48	200.0	△7	⊙75	37	16	47	1,656.5
⧋20	⊙47	102	08	25	3,523.4	△7	⊙63	244	50	30	1,563.5
⊙117	⊙47	269	59	25	580.8	⧋7	⊙65	283	36	52	1,375.0
△22	⊙47	65	18	05	6,387.9	⊙63	⊙65	4	33	45	991.5
⊙115	⊙49	269	59	14	54.8	⊙65	⊙67	344	59	52	1,169.2
△17	⊙49	129	10	34	4,611.8	⊙67	⊙69	74	44	07	1,612.9
△19	⊙49	68	24	14	1,622.4	⊙69	⊙71				901.0
⊙53	⊙51	61	30	10	804.8	⊙71	⊙73	164	44	07	266.7
⊙51	⊙113				844.2	⊙73	⊙75				559.5
⊙113	⊙55	151	30	10	1,013.4	△9	⊙63	39	48	42	640.3
⊙55	⊙57	241	32	00	518.5	⧋9	⊙45	351	35	20	282.9
⊙57	⊙51	313	41	00	1,064.2	⊙45	⊙63	64	50	20	499.0
⧋17	⊙57	117	42	44	3,175.8	⊙37	⊙39	182	16	00	311.8
⧋19	⊙57	20	07	04	2,165.8	⊙39	⧋11	59	07	14	376.0
△17	⊙53	130	08	45	1,746.9	⧋11	⊙41	20	27	00	478.0
△18	⊙53	53	47	05	3,580.9	⊙37	⊙41	55	24	00	580.2
△18	⊙59	8	07	00	3,659.8	⊙41	⊙43				310.7
△17	⊙59	290	11	00	1,104.8	⊙43	⊙45	61	15	00	1,528.3
⊙59	⊙111	2	01	30	532.7	⧋15	⊙93	357	19	38	2,440.8
△17	⊙31	266	18	00	3,265.8	⊙93	⊙95	2	08	58	2,643.2
⊙58	⊙31	347	54	00	2,296.3	⊙95	⊙97	92	15	38	2,636.7
△1	⊙58	122	42	05	1,998.7	⊙97	⊙33	182	15	38	1,574.0
△2	⊙58	46	32	45	1,384.7	⊙33	⧋13	216	55	38	589.4
⊙61	⊙107	345	41	15	95.7	⊙93	⊙89	92	08	58	1,658.2
⊙61	⊙109	345	41	15	1,100.0						

WAR DEPARTMENT, *August 22, 1904.*

Approved.

WM. H. TAFT,
Secretary of War.

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APPENDIX B B.

IMPROVEMENT OF CUMBERLAND RIVER, TENNESSEE AND KENTUCKY, AND OF OBION AND FORKED DEER RIVERS, TENNESSEE.

REPORT OF MAJ. H. C. NEWCOMER, CORPS OF ENGINEERS, OFFICER IN CHARGE FOR THE FISCAL YEAR ENDING JUNE 30, 1905, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Obion and Forked Deer rivers, Tennessee.
2. Cumberland River, Tennessee and Kentucky.

ENGINEER OFFICE, UNITED STATES ARMY,
Nashville, Tenn., July 19, 1905.

GENERAL: I have the honor to transmit herewith the annual report * * * upon the river improvements in my charge relating to the Nashville, Tenn., district for the fiscal year ending June 30, 1905.

Very respectfully,

H. C. NEWCOMER,
Major, Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

B B 1.

IMPROVEMENT OF OBION AND FORKED DEER RIVERS, TENNESSEE.

Brief accounts of these rivers, with references to former reports containing additional details are given in the Annual Report of the Chief of Engineers for this year, page 447.

(*a*) *Obion River.*—No work was done on this stream during the past fiscal year. The total expenditures for the fiscal year ending June 30, 1905, amounting to $138.45, were applied to the care of floating plant. It is proposed to apply the balance available and the additional appropriation recommended to maintenance of the navigable waterway by removal of snags and other channel obstructions, and to care of floating plant.

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Money statement.

July 1, 1904, balance unexpended	$281.33
Amount allotted from river and harbor act approved March 3, 1905	1,700.00
	1,981.33
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	138.45
July 1, 1905, balance unexpended	1,842.88
July 1, 1905, outstanding liabilities	13.00
July 1, 1905, balance available	1,829.88
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	800.00

(*b*) *Forked Deer River.*—No work was done on this stream during the past fiscal year. The total expenditures for fiscal year ending June 30, 1905, amounting to $132.18, were applied to the care of floating plant. It is proposed to apply the balance available and the additional appropriation recommended to maintenance of the navigable waterway by removal of snags and other channel obstructions and to care of floating plant.

Money statement.

July 1, 1904, balance unexpended	$381.13
Amount allotted from river and harbor act approved March 3, 1905	1,300.00
	1,681.13
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	132.18
July 1, 1905, balance unexpended	1,548.95
July 1, 1905, outstanding liabilities	11.50
July 1, 1905, balance available	1,537.45
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	700.00

APPROPRIATIONS.

Obion River, Tennessee.

By act of—	
July 13, 1892	$7,500
August 18, 1894	7,500
June 3, 1896	6,000
March 3, 1899 (for maintenance)	2,500
June 13, 1902 (allotment for maintenance)	2,500
March 3, 1905 (allotment for maintenance)	1,700
Total	27,700

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Forked Deer River, Tennessee, and its navigable branches.

By act of—	
August 2, 1882, for South Fork	$3,000
July 5, 1884, for South Fork	2,000
August 5, 1886, for South Fork	5,000
August 11, 1888, for South Fork	2,500
August 11, 1888, for North Fork	4,500
August 11, 1888, for main river	2,500
September 19, 1890, for North Fork and main river	2,500
July 13, 1892, for Forked Deer (completing improvement)	3,000
Total to complete old project	25,000
Present project, by act of—	
June 3, 1896, for Forked Deer River (for maintenance)	1,000
June 3, 1896, for North Fork of Middle Fork from Dyersburg to Mississippi River	5,000
March 3, 1899, for Forked Deer River (for maintenance)	2,000
June 13, 1902 (allotment for maintenance)	2,000
March 3, 1905 (allotment for maintenance)	1,300
Total	11,300

COMMERCIAL STATISTICS.

Obion and Forked Deer rivers, Tennessee, from January 1 to December 31, 1904.

	Tons.
Logs	47,409
Lumber	2,289
Stave bolts	9,450
Spokes and bolts	650
Grain	58
Other farm products (hay)	30
Live stock	50
Sand and gravel	100
General merchandise	250
Total tonnage	60,286
Estimated value	$627,108
Passengers carried (estimated)	2,337

Comparative statement of traffic on Obion and Forked Deer rivers for six years.

Calendar year.	Tons.	Calendar year.	Tons.
1899	118,622	1902	117,415
1900	214,907	1903	22,576
1901	26,717	1904	60,286

List of steamboats (stern-wheel) plying upon Obion and Forked Deer rivers, calendar year 1904.

Name.	Registered dimensions.			Net tonnage.
	Length.	Breadth.	Depth.	
	Feet.	*Feet.*	*Feet.*	
A. R. Hall (screw)	72.0	15.0	11.5	89
Gypsy	53.0	8.5	3.4	14
Jacob Heatherington	128.0	24.0	4.2	192
Hock White	60.0	15.0	2.5	14
Joy Patton	100.0	21.3	5.6	63
L. H. Buhrman	112.6	23.2	4.9	80
Minnehaha	90.0	18.0	3.0	46
Sarah	79.0	25.6	5.5	17
Verona	43.2	11.0	2.0	6

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BB 2.

IMPROVEMENT OF CUMBERLAND RIVER, TENNESSEE AND KENTUCKY.

(A) BELOW NASHVILLE, TENN. (193 MILES).

For description of this stream and references to former reports giving additional details, see page 448 of the Annual Report of the Chief of Engineers for this year.

The principal work done on this section during the past fiscal year was the erection of the gates and construction of the dam at Lock A, by contract and hired labor respectively. Contracts with Penn Bridge Company for the gates, and with W. C. Rodgers for timber for dam were closed and terminated November 16, 1904, and August 10, 1904, respectively. (See report of Chief of Engineers, 1904, p. 2340.) The lock was put in operation in November, 1904, and since then the force has been employed principally in operating and maintaining the lock, building road to lock keeper's quarters, quarrying stone and repairing damage to protected bank below abutment by placing riprap on slope and heavy stone at toe of bank.

During the fiscal year ending June 30, 1905, $72,434.03 were expended, of which $72,176.61 were applied to the work at Lock A and contingencies, and $257.42 to maintenance (repairs of snag boat).

The following is a statement of the quantities in connection with work at Lock A during the past fiscal year:

Stone quarried	cubic yards	7,000
Heavy stone placed on abutment bank	do	1,540
Riprap placed on and below abutment bank	do	2,850
Removing mud from lock chamber	do	1,000
Placing concrete in upper end of lock chamber	do	11
Guard crib:		
Timber framed	feet B. M.	109,420
Stone filling	cubic yards	2,000
Paving on top	square yards	120
Dam:		
Timber framed	feet B. M.	700,000
Stone filling	cubic yards	13,468
Placing riprap in river above dam	do	80
Dredge boat:		
Dredging gravel from river for dam foundation	do	3,500
Gravel filling above dam	do	12,375
Dredging material out of lower approach to lock	do	3,375

Work in connection with installation of lock gates consisted in placing filling valves, maneuvering appliances, check posts, ladders, etc., and building temporary dam at lower end of lock. Other work consisted in removing material below lock, pointing river wall, and construction of removable needle dam. Four barges, 2 derrick boats, and 1 dump scow were calked, and minor repairs made to plant and buildings, and the same cared for.

The U. S. steamers *Cumberland*, *John*, and *Henry* were in commission and employed in towing material and supplies in connection with the work at Lock and Dam A.

Since the completion of Dam A, the stage of water in river has never been sufficient to submerge the lock walls. On February 10, 1905, with 15.1 feet on upper gauge and 20.2 feet on lower gauge and

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a fall of 8 feet over dam, the drift began to accumulate in the reaction or back lash below the dam and was held there until February 17, 1905, when, with a fall of 9.2 feet over dam, the drift disappeared. On March 10, 1905, with 16 feet upper gauge, 21.6 feet lower gauge, and 5 feet fall over dam, the drift again began to accumulate and was held until March 17, 1905, when the fall was 6.4 feet over dam. During these two periods, the drift caught in this reaction or back lash inflicted serious injury to the roof of the dam, destroying apparently about one-fifth of the lower half of the slope sheeting. The river has not been sufficiently low to permit the full extent of the damage to be ascertained.

The low-water season on the lower Cumberland River was unusually prolonged.

It is proposed to apply the available balance to repairing damage to Dam A, protecting bank below abutment, constructing lock keeper's house, and maintaining open river channel; and the additional appropriation recommended, to location and acquisition of the sites of locks and abutments of Dams B, C, and D and to construction of Lock and Dam B.

Money statement.

July 1, 1904, balance unexpended		$100,557.55
Amount appropriated by river and harbor act approved March 3, 1905.		10,000.00
Received on account of sales		8.95
		110,566.50
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$72,176.61	
For maintenance of improvement	257.42	
		72,434.03
July 1, 1905, balance unexpended		38,132.47
July 1, 1905, outstanding liabilities		1,487.82
July 1, 1905, balance available		36,644.65
Amount (estimated) required for completion of existing project		1,524,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905		300,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.		

APPROPRIATIONS.

Improving Cumberland River below Nashville, Tenn., under old project for open-channel work, from 1871 to 1890.

Act of—		Act of—	
March 3, 1871	$30,000	August 5, 1882	$15,000
June 10, 1872	20,000	July 5, 1884	7,500
March 3, 1873	25,000	August 5, 1886	12,500
March 3, 1875	25,000	August 11, 1888	10,000
June 18, 1878	45,000	September 19, 1890	40,000
March 3, 1879	40,000		
June 14, 1880	20,000	Total	305,000
March 3, 1881	15,000		

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Under new project for locks and dams, from 1892 to 1905.

Act of—	
July 13, 1892	$40,000.00
August 18, 1894	30,000.00
June 3, 1896	80,000.00
March 3, 1899	100,000.00
Amended act of June 13, 1902	180,000.00
Act of March 3, 1905	10,000.00
Total	440,000.00
Received, account of sales	970.90
Cash deposit taken up, pay due sundry persons uncalled for	3.15
Aggregate	440,974.05

CONTRACTS IN FORCE.

Improving Cumberland River above and below Nashville, Tenn.

FORMAL CONTRACTS.

1. For construction of 1 dredge, at $18,650.
   Contractor: Featherstone Foundry and Machine Company.
   Date of contract: December 15, 1902.
   Date of approval: January 8, 1903.
   Date of beginning work: June 2, 1903.
   Date of expiration: May 1, 1903. (Time limit waived, as authorized by the Chief of Engineers, United States Army, April 25, 1903.)
   Final payment made: August 5, 1904.
2. For construction, delivery, and erection of 2 pairs of steel lock gates, filling valves, etc., for Lock A, below Nashville, at $17,550; and 2 pairs steel lock gates, filling valves, etc., for Lock No. 1, above Nashville, at $15,400.
   Contractor: Penn Bridge Company.
   Date of contract: December 4, 1903.
   Date of approval: January 4, 1904.
   Date of beginning work: December 9, 1903.
   Date of expiration: September 30, 1904. (Time limit waived, as authorized by the Chief of engineers, United States Army, September 28, 1904.)
   Final payment made: November 16, 1904.
3. For furnishing and delivering 967,660 feet B. M. yellow pine timber for Dam A, below Nashville, at $23 per thousand feet B. M., and 502,539 feet B. M. for Dam No. 1, above Nashville, at $22.50 per thousand feet B. M.
   Contractor: W. C. Rodgers.
   Date of contract: March 18, 1904.
   Date of approval: April 7, 1904.
   Date of beginning work: April 12, 1904.
   Date of expiration: June 15, 1904. (Time limit waived, as authorized by the Chief of Engineers, United States Army, June 15, 1904.)
   Final payment made: August 10, 1904.
4. For construction, delivery, and erection of 2 steel lock gates, filling valves, etc., for Lock No. 2, above Nashville, at $15,715.
   Contractor: Lawrence D. Weaning.
   Date of contract: June 15, 1905.
   Date of approval: July 3, 1905.
   Date of beginning work: June, 1905.
   Date of expiration: October 31, 1905.

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EMERGENCY CONTRACTS.

5. For office rent.
   Lessor: Estate of Temple O. Harris, deceased.
   Date: March 31, 1905.
   Rate: $60 per month.
   Termination: On 30 days' notice.
6. For lease of land for storing of timber during construction of Dam No. 2, Cumberland River.
   Lessors: Thos. W. & H. B. Chadwell.
   Date: June 26, 1905.
   Rate: $60 lump sum during occupancy.
   Termination: On completion of Dam No. 2.

COMMERCIAL STATISTICS.

Cumberland River below Nashville, Tenn., from January 1 to December 31, 1904.

	Tons.
Logs	6,344
Lumber	11,111
Railroad ties	207,857
Hoop poles	500
Staves	2,350
Tobacco	3,150
Grain	14,500
Other farm products	849
Iron, manufactured	400
Sand and gravel	7,250
Lime and cement	1,049
Explosives	50
Live stock:	
Large	1,500
Small	263
General merchandise	8,198
Total tonnage	275,371
Estimated value	$3,034,600
Passengers carried	7,550

Passed Lock and Dam A.—1,088 tons, 39 lockages, 18 passengers. Lock was put in operation November 26, 1904, and tonnage passing lock is between said date and December 31, 1904.

The Ryman line of steamers, operating on both upper and lower river, added 3 packets and established a wharf boat at Nashville with a capacity of 600 tons.

The agent of the Ryman line of steamers reports that in the past sixty days more corn, to the extent of 28,000 bags, has been brought to Nashville by two of their boats than could have been transported on the same trips before Lock A was in operation.

Comparative statement of traffic for six years.

Calendar year.	Tons.	Calendar year.	Tons.
1899	263,608	1902	263,531
1900	407,088	1903	297,438
1901	256,567	1904	275,371

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List of steamboats (stern-wheel) plying on the Cumberland River below Nashville, Tenn., calendar year 1904.

Name.	Registered dimensions.			Net tonnage.
	Length.	Breadth.	Depth.	
	Feet.	*Feet.*	*Feet.*	
A. L. Goldberg	129.0	20.0	3.0	58
Bart E. Linehan	127.0	28.5	3.9	178
Bob Dudley	160.0	29.0	3.8	159
Castalia	110.0	26.2	3.7	90
Charles Turner	104.0	20.0	3.0	73
Geo. H. Cowling	120.0	28.0	4.0	88
H. W. Buttorff	160.0	30.0	4.1	160
Henry Harley	160 0	29.0	3.2	162
Henrietta	130 0	24.0	4.3	158
I. N. Hook	109.9	19.4	3.0	55
Illinois	139.0	26.6	4.8	168
India Givens	170.0	29.0	4.6	211
Inverness	129.0	21.0	4.8	121
J. B. Richardson	165.0	29.0	4.0	191
John S. Summers	108.2	21.3	3.4	66
Kuttawa (gasoline)	58.0	10.0	2.5	12
Little Ben (gasoline)	70.6	18.0	2.8	33
Lora	70.0	12.0	2.5	44
Lula E. Warren	122.0	22.5	3.3	78
Lyda	122.0	24.0	2.4	80
Martha H. Hennen	112.0	23.0	4.8	77
Mary Hill	100.0	24.0	3.0	72
Mary F. Golden	86.2	16.2	3.6	37
Mary M. Michael	143.0	26.3	4.4	234
Mary N	69.0	14.0	3.0	36
Morning Star	96.0	20.0	2.4	46
Pavonia	120.0	26.0	4.0	132
Penguin	80.0	16.6	3.4	60
Starlight	55.0	14.0	2.0	11
Sycamore	108.6	20.3	3.0	72
T. L. Herbert	117.0	24.0	3.6	80
Victor	120.0	26.0	4.0	100
Wilford	85.0	18.8	3.0	47

(B) ABOVE NASHVILLE, TENN. (357 MILES).

For description of Cumberland River above Nashville and references to former reports containing additional details, see the Annual Report of the Chief of Engineers, for this year, page 450.

The amount expended under the existing project during fiscal year ending June 30, 1905, is $59,526.41, the disbursements being divided as follows:

General improvement:		
Lock No. 1	$47,435.85	
Lock No. 2	1,139.45	
Lock No. 3	171.35	
Lock No. 4	179.85	
		$48,926.50
Maintenance:		
Lock No. 2	20.00	
Lock No. 3	15.00	
Lock No. 4	15.00	
Lock No. 5	5.27	
Channel work	647.44	
		702.71
Locks Nos. 5, 6, and 7:		
Lock No. 5		294.73
Locks and dams Nos. 1, 5, 6, and 7:		
Lock No. 1		8,400.00
Lock and Dam No. 21		1,202.47
		59,526.41

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The following is an account of the work done:

Lock No. 1.—For statement regarding proposals solicited and contracts let for lock gates and dam timber, see Report of the Chief of Engineers for 1904, page 2340. The principal work done was the erection of lock gates under contract and construction of the dam by hired labor. The lock was put in operation in November, 1904. A rock fence to replace old wooden fence running along the public road was finished; other work done was grading and paving bank and road, building retaining wall, and finishing guard pier at upper end of lock.

The U. S. steamers *Cumberland*, *Henry*, and *John* were in commission and employed in towing materials and supplies in connection with the work.

At the close of the fiscal year the working force at Lock No. 1 was engaged in moving to Lock No. 2 preparatory to commencing operations at that point.

The quantities of the work done at Lock No. 1 were as follows:

Stone quarried	cubic yards..	1,831
Stone fence built	do....	607
Retaining wall built	do....	549
Paving on bank above lock	do....	210
Mud removed from lock chamber	do....	1,375
Sand screened and delivered	do....	220
Guard crib:		
Timber framed	feet B. M..	75,273
Stone filling	cubic yards..	1,000
Paving on top	square yards..	120
Dam:		
Timber framed	feet B. M..	341,681
Stone filling	cubic yards..	6,000
Gravel excavated for foundation	do....	355
Filling above dam with earth and stone	do....	1,900
Dredge boat:		
Dredged material placed above dam	cubic yards..	7,900

Work in connection with installation of lock gates consisted in placing filling valves, maneuvering appliances, check posts, ladders, etc.; temporary dams at upper and lower ends of lock built. Other work consisted in removing material below lock, construction of needle dams, repairing snag boat, calking two barges, making scale boards, and minor repairs and caring for buildings and plant.

Lock No. 2.—During the fiscal year plans for the lock gates and dam were prepared, submitted, and approved. Proposals for construction and erection of the two steel lock gates, etc., were solicited under thirty-day newspaper advertisement, dated April 29, 1905, and contract entered into June 15, 1905, with the lowest bidder, Lawrence D. Weaning, of Cleveland, Ohio, in the sum of $15,715. Contract provides for completion and erection by October 31, 1905. Proposals for dam timber were also invited under date of May 4, 1905, for furnishing about 453,406 feet B. M. long-leaf yellow pine. Three formal bids were received, as follows: $43, $36, and $32 per M feet B. M. One informal bid of $29.50 per M was also received, and it was recommended that this be accepted, but the Chief of Engineers directed that all bids be rejected and the work readvertised for a limited period. Proposals have been invited again for July 8, 1905.

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Lock No. 21.—The river and harbor act of March 3, 1905, provides as follows:

For the construction of Lock and Dam Numbered twenty-one in said river, seventy-four thousand dollars: *Provided*, That a contract or contracts may be entered into by the Secretary of War for such materials and work as may be necessary to complete the said lock and dam, to be paid for as appropriations may from time to time be made by law, not to exceed in the aggregate two hundred thousand dollars, exclusive of the amounts herein and heretofore appropriated: *Provided further*, That the balance remaining to the credit of the Cumberland River on any project therein above said lock and dam numbered twenty-one shall be made applicable for the construction thereof.

Plans and specifications covering all parts except the metal work of Lock and Dam No. 21 were prepared and submitted for approval June 9, 1905, provision being made for concrete dam.

Snagging.—The snag boat *Apex* was put in thorough repair and snagging party sent to Burnside, Ky., in tow of U. S. S. *John* on June 6, 1905, from which point it will operate downstream removing surface obstructions, etc. It took sixteen days to reach Burnside on account of low water. The details of the work done during fiscal year are as follows, 65 miles of river having been cleared:

Snags removed	70
Snags cut	46
Trees cut	290
Trees deadened	39
Logs cut	24

The continued low water during 1904 curtailed the boating season so much that some six or seven million feet of lumber were left on bank of river above Nashville. The boating season from January, 1094, to January, 1905, has been the most trying one on record for steamboat interests on account of the low water.

The river and harbor act of March 3, 1905, provides that the balance on hand to the credit of the Cumberland River above Nashville for general improvement and for Locks Nos. 5, 6, and 7 shall be applied to the construction of Lock and Dam No. 2; and that the balance remaining to the credit of the Cumberland River on any project above Lock and Dam No. 21 shall be made applicable for the construction thereof. The balances thus available June 30, 1905, are $58,355.83, $8,302.18, and $25,419.98, respectively. The balance on hand for maintenance, $9,297.29, will be applied in snagging and care of plant and preservation of works of improvement. No provision has yet been made for the completion of Locks and Dams Nos. 3 to 7. The present state of these locks is such that, in order to make them available for the purposes of commerce and navigation, it will only be necessary to provide for the installation of the necessary gates and maneuvering appliances and for the construction of the dams and buildings. It is believed that this can be accomplished by an expenditure of $550,000, and it is therefore recommended that this sum be appropriated in order that these locks may be utilized for the purposes for which intended at the earliest date practicable. In addition, it is recommended that $200,000 be appropriated for Lock and Dam No. 21, to be expended under continuing contract, as provided by the act of March 3, 1905.

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Money statement.

July 1, 1904, balance unexpended		$152,709.89
Amount appropriated by river and harbor act approved March 3, 1905		124,000.00
Received on account of sales		15.80
		276,725.69
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$58,823.70	
For maintenance of improvement	702.71	
		59,526.41
July 1, 1905, balance unexpended		217,199.28
July 1, 1905, outstanding liabilities		2,131.52
July 1, 1905, balance available		215,067.76
July 1, 1905, amount covered by uncompleted contracts		15,715.00
Amount (estimated) required for completion of existing project		6,481,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905. Submitted in compliance with requirements of sundry civil act of June 4, 1897.		750,000.00

APPROPRIATIONS.

Improving Cumberland River above Nashville, Tenn., under original projects for open-channel work, from 1876 to 1884.

Geographical division.	Act of—			
	Aug. 14, 1876.	June 18, 1878.	Mar. 3, 1879.	June 14, 1880.
1. Nashville to Kentucky line	$15,000	$20,000	$18,000	$15,000
2. Kentucky line to Smith shoals	10,000	8,000	6,000	10,000
3. Smith shoals	25,000	30,000	15,000	20,000
4. Smith shoals to Falls of Cumberland	2,000	2,000	.....	.....
Total	52,000	60,000	39,000	45,000

Geographical division.	Act of—			Total.
	Mar. 3, 1881.	Aug. 2, 1882.	July 5, 1884.	
1. Nashville to Kentucky line	$15,000	.....	.....	$88,000
2. Kentucky line to Smith shoals	15,000	.....	.....	49,000
3. Smith shoals	10,000	$15,000	.....	115,000
4. Smith shoals to Falls of Cumberland	.....	.....	.....	4,000
5. Above mouth of Jellico, Ky	10,000	5,000	.....	15,000
6. Nashville to Smith shoals	.....	30,000	.....	30,000
7. Nashville to head of Smith shoals	.....	.....	$50,000	50,000
Total	50,000	50,000	50,000	346,000

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Improving Cumberland River above Nashville, Tenn., under the present project for a system of locks and dams from Nashville, Tenn., to head of Smith shoals, mouth of Rockcastle River, Kentucky.

Act of—	
August 5, 1886	$75,000.00
August 11, 1888	200,000.00
September 19, 1890	250,000.00
July 13, 1892	250,000.00
August 18, 1894	200,000.00
June 3, 1896	20,000.00
June 4, 1897 (sundry civil act)	350,000.00
July 1, 1898 (sundry civil act)	250,000.00
March 3, 1899	100,000.00
Amended act of June 13, 1902	200,000.00
March 3, 1905	124,000.00
Total	2,019,000.00
Amount recovered from failing contractor	450.17
Cash deposit taken up, pay due sundry persons uncalled for	2.70
Cash deposit: Redemption of United States internal-revenue stamps	2.18
Received on account of sales	15.80
Aggregate	2,019,470.85

CONTRACTS IN FORCE.

For contracts in force, see report Cumberland River below Nashville.

COMMERCIAL STATISTICS.

Cumberland River above Nashville, Tenn., from January 1 to December 31, 1904.

	Tons.
Logs	93,123
Lumber	12,144
Railroad ties	21,000
Poles	15,340
Hoop poles	500
Staves	32,550
Wood	960
Tobacco	2,367
Grain	11,600
Other farm products	1,900
Iron, manufactured	950
Sand and gravel	27,750
Lime and cement	375
Explosives	50
Live stock:	
Large	1,225
Small	1,278
General merchandise	17,000
Fertilizers	2,000
Total tonnage	242,112
Estimated value	$5,862,365
Passengers carried	7,200

Passed Lock and Dam No. 1, 3,305.5 tons, 79 lockages, 800 passengers. Lock was put in operation November 26, 1904, and tonnage passing lock is between said date and December 31, 1904.

The following steamboat lines were established:

Nashville Transportation Company, Nashville, Tenn., with 2 towboats and 15 barges.

Cumberland and Tennessee Transportation Company, Carthage, Tenn., operated by Tennessee Central Railroad Company, with 2 towboats and 12 barges.

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Comparative statement of traffic for six years.

Calendar year.	Tons.	Calendar year.	Tons.
1899	294,763	1902	192,270
1900	289,218	1903	304,462
1901	267,211	1904	242,112

List of steamboats (stern wheel) plying on the Cumberland River above Nashville, Tenn., and in Kentucky, calendar year 1904.

Name.	Registered dimensions.			Net tonnage.
	Length.	Breadth.	Depth.	
	Feet.	*Feet.*	*Feet.*	
A. L. Goldberg	129.0	20.0	3.0—	58
Albany	120.0	21.0	2.5—	52
Bart E. Linehan	127.0	23.5	3.9—	178
Bob Dudley	160.0	29.0	3.8—	159
Burkesville	116.5	17.1	3.8—	59
Eadsville (gasoline)	44.0	8.0	1.4—	2
Henry Harley	160.0	29.0	3.2—	162
Little Ben (gasoline)	70.6	18.0	2.8—	33
Lora	70.0	12.0	2.5—	44
Morning Star	95.0	20.0	2.4—	46
Obey's Friend (gasoline)	64.4	15.2	1.8—	10
R. Dunbar	160.0	29.0	6.4—	158
Samuel H. Anderson (gasoline)	50.0	8.5	1.4—	5
Starlight	55.0	14.0	2.0—	11
T. L. Herbert	117.0	24.0	3.6—	80
Warrenn	134.3	26.0	4.0—	98

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APPENDIX C C.

IMPROVEMENT OF TENNESSEE RIVER AND ITS TRIBUTARIES.

REPORT OF MAJ. H. C. NEWCOMER, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1905, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Tennessee River.
2. Operating and care of Muscle Shoals Canal, Tennessee River.
3. French Broad and Little Pigeon rivers, Tennessee.
4. Clinch, Hiwassee, and Holston rivers, Tennessee and Virginia.

SPECIAL REPORT.

5. Tennessee River at Muscle Shoals Canal, land and water power.

ENGINEER OFFICE, UNITED STATES ARMY,
Chattanooga, Tenn., July 20, 1905.

GENERAL: I have the honor to transmit herewith the annual report for the Chattanooga district for the fiscal year ending June 30, 1905.

Very respectfully, your obedient servant,

H. C. NEWCOMER,
Major, Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

C C 1.

IMPROVEMENT OF TENNESSEE RIVER.

For general description of the Tennessee River system and references to former reports giving more detailed accounts of various portions of the river, see page 454 of the Annual Report of the Chief of Engineers for this year.

For purposes of appropriations the river has been divided into the following different sections:

(1) ABOVE CHATTANOOGA (188 MILES).

No work of improvement was done this year by the United States until after the appropriation of March 3, 1905. The small balance

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available July 1, 1904, was applied to the preservation and repair of floating plant.

Under authority of the Secretary of War dated October 4, 1904, some of the floating plant was employed in removing several obstructions at Knoxville, without expense to the United States, the city of Knoxville and private parties assuming all charges. These obstructions consisted of three submerged stone piers which had formed part of the old county bridge at Knoxville and had not been removed when the rest of the old bridge was taken down at the time of the completion of the new bridge in 1899, and of two crib piers situated near the left bank of the river just above the county bridge, which were the remains of a military bridge built by General Burnside during the civil war. The hulk of the sunken steamer *Flora Swann*, which had been lying several months at the upper wharf at Knoxville, was also removed by its owners in November, 1904.

As soon as practicable after the appropriation of $50,000 by the act of March 3, 1905, a force was put to work repairing the dredge *Kwasind*, steamer *Long*, and such other pieces of the floating plant as were needed for immediate use.

Dredging in Long Island Chute, 106 miles above Chattanooga, began May 8, and was continued to the end of the fiscal year, when about 22,000 cubic yards had been dredged in three cuts, having an aggregate length of about 7,500 feet, and forming a channel about 90 feet wide, with a depth of about 4 feet at low water.

It is proposed to apply the available balance and the additional appropriation recommended to the maintenance of the channel and continuing improvement at the worst shoals.

Money statement.

July 1, 1904, balance unexpended		$2,058.50
Proceeds sales of property condemned and transferred		127.58
Amount appropriated by river and harbor act approved March 3, 1905		50,000.00
		52,186.08
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$4,266.39	
For maintenance of improvement	2,186.08	
		6,452.47
July 1, 1905, balance unexpended		45,733.61
July 1, 1905, outstanding liabilities		2,811.43
July 1, 1905, balance available		42,922.18
Amount (estimated) required for completion of existing project		455,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$100,000.00	
For maintenance of improvement	5,000.00	
		105,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

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APPROPRIATIONS.

April 10, 1869	$35,000.00	July 13, 1892	$25,000.00
March 3, 1871, transferred from below Chattanooga	35,000.00	August 18, 1894	50,000.00
June 10, 1872	25,000.00	June 3, 1896	15,000.00
March 3, 1873	25,000.00	March 3, 1899	30,000.00
June 23, 1874	25,000.00	June 13, 1902	50,000.00
March 3, 1875	40,000.00	March 3, 1905	50,000.00
August 14, 1876	15,000.00		526,000.00
June 18, 1878	15,000.00	July, 1903, proceeds of sales of condemned property	1.77
March 3, 1879	11,500.00	August, 1904, proceeds of sales of condemned property	2.58
June 14, 1880	10,000.00	February, 1905, proceeds of transfer of steam drill	125.00
March 3, 1881	7,000.00		
August 2, 1882	7,000.00		
July 5, 1884	3,000.00		
August 5, 1886	7,500.00		
August 11, 1888	15.000.00		
September 19, 1890	30,000.00	Total	526,129.35

(2) CHATTANOOGA, TENN., TO RIVERTON, ALA. (238 MILES).

(A) COLBERT SHOALS CANAL (8 MILES).

The masonry work of the lift lock and its approaches at the lower end of this canal, at Riverton, was begun in 1893 and completed in 1900, according to the project then in force.

Under the act of June 13, 1902, authorizing additional contracts for this work to the amount of $600,000, a contract was made in May, 1903, with the Sheridan-Kirk Contract Company for building the upper section of the canal, including the construction of a concrete river wall about 10,500 feet long, and the excavation of about 57,000 cubic yards of earth and 143,000 cubic yards of rock from the canal trunk. A contract supplemental to this was entered into December 14, 1903, with the object of extending the lower end of the concrete river wall about 1,500 linear feet—thus completing it to the site of the proposed guard lock—by permitting the substitution of a rock-fill dam with rubble masonry toe wall for about 5,500 feet of the upper end of the wall. A further supplemental agreement was entered into September 29, 1904, permitting the use of concrete instead of rubble masonry in the toe wall, not less than 2 feet thick, which is to be built along the line of the omitted concrete wall, having its top at elevation 34. The rock-fill dam is to rise from this toe wall with a slope not steeper than 1 on 1½ to elevation 42, with a top width of not less than 40 feet, measured from inside of toe wall. The extreme low-water elevation in the canal is assumed at 33.5.

Work done by the contractors during the year was as follows:

Earth excavated	cubic yards	35,093
Rock excavated	do	42,588
Concrete river wall built	do	1,230

No work was done during the months of January, February, March, and April of the current year, as the cofferdams were flooded by the usual winter and spring rises in the river.

The estimated cost of completing the canal, exclusive of funds now available, is $1,252,000. Contracts amounting to $200,000 of this sum are already authorized, and it is urged that authority be given to enter

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into further contracts amounting to $1,052,000, the work to be paid for as appropriations may be made by law from time to time. Only the lack of funds has prevented work being carried on in the lower section of the canal simultaneously with the construction of the upper section.

Just prior to his departure from this district, Capt. W. J. Barden, Corps of Engineers, recommended shifting the canal trunk from the river side toward the land side of the canal right of way and the purchase of the lands lying between the canal right of way and the river, amounting to about 181 acres, in order to facilitate work on the canal trunk, and a modification of the canal project by the omission of the guard lock and raising the walls and gates of the lift lock from elevation 37.5 to 42, and crests of weirs from 34 to 41, thus giving an open canal about 8 miles long with a single lock at its lower end, so arranged as to permit the passage of boats until the river rises to a 7-foot stage at the head of the shoals, when navigation in the open river becomes practicable.

The Secretary of War authorized the purchase of the lands between the canal and the river on June 23, 1904. These lands were owned by seven different parties. Agreements were made with six of these for the purchase of their tracts, and condemnation proceedings were had to secure the seventh tract. It is understood that the necessary papers for the transfer of these lands to the United States have been practically completed by the United States attorney.

On March 20, 1905, a board of officers of the Corps of Engineers, consisting of Lieut. Col. W. H. Bixby, Maj. Geo. A. Zinn, and Capt. Harry Burgess was appointed to consider and report upon the proposed changes in the project. Their report approving the changes was submitted April 28, 1905, and upon the recommendation of the Chief of Engineers these changes were authorized by the Secretary of War on June 12, 1905.

It is proposed to apply the balance available for this work, and the additional appropriation recommended, to the completion of the concrete river wall and excavation of the canal trunk.

Money statement.

July 1, 1904, balance unexpended	$489,123.78
Amount appropriated by river and harbor act approved March 3, 1905.	200,000.00
Amount appropriated by sundry civil act approved March 3, 1905	50,000.00
Proceeds sales of condemned property and overpayment refunded	9.80
	739,133.58
June 30, 1905, amount expended during fiscal year, for works of improvement	118,289.11
July 1, 1905, balance unexpended	620,844.47
July 1, 1905, outstanding liabilities	31,854.47
July 1, 1905, balance available	588,990.00
July 1, 1905, amount covered by uncompleted contracts	378,322.84
Amount (estimated) required for completion of existing project	1,252,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	400,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

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APPROPRIATIONS.

Colbert and Bee Tree shoals.

September 19, 1890	$150,000.00
July 13, 1892	300,000.00
August 14, 1894	245,000.00
March 3, 1899	100,000.00
June 13, 1902	200,000.00
March 3, 1903 (sundry civil act)	350,000.00
March 3, 1905	200,000.00
March 3, 1905 (sundry civil act)	50,000.00
	1,595,000.00
August 11, 1904, proceeds of sales of condemned property	9.46
October 8, 1904, overpayment refunded	.34
Total	1,595,009.80

(B) HALES BAR LOCK AND DAM (33 MILES BELOW CHATTANOOGA).

The city of Chattanooga having failed to undertake the work of building the lock and dam authorized by the act of April 26, 1904, and Messrs. C. E. James and J. C. Guild having signified their intention of proceeding with it in accordance with the terms of the act as amended by act of January 7, 1905, the Secretary of War, on May 24, 1905, granted them formal permission for the work and approved the location at Hales bar, as requested by them.

Work on the plans and specifications has been in more or less active progress during the entire year. In September, 1904, a field party under charge of Surveyor J. E. Hall was set to work examining the foundations for the lock and dam at the original location at Scott Point, about 17 miles below Chattanooga. About 40 soundings or borings to locate the bed rock were made by means of steel rods and sinking pipes with the water jet. The latter method was found to be of little use on account of the large gravel encountered. The results obtained appeared to indicate bed rock at depths varying from about 3 to 13 feet below extreme low water, which was assumed at elevation of about 603.5. Subsequent work, however, with the dredge *Kentucky* at other sites throws considerable doubt on the reliability of these indications.

After this work was accomplished and considerable progress had been made on the plans for a lock and dam at this site, fixing the crest of the dam at elevation 631 (zero of gauge at Chattanooga being at 630.6), it was decided that, if practicable, a site should be located farther downstream, where the conditions would be more favorable for the development of water power. The site at Scott Point was recommended by Maj. Dan C. Kingman in his project for the improvement of the mountain section, considering merely the most economical method of removing the obstructions to navigation, and it appears to be the most satisfactory location for this purpose. On the other hand, increased efficiency as a power plant, without any sacrifice of the interests of navigation, appears to more than justify the larger cost of construction at a point lower downstream.

Messrs. James and Guild therefore petitioned Congress to authorize a change in the location, and this was done by the act of January 7, 1905. As soon thereafter as practicable the dredge *Kentucky*, with its attendant floating plant, was brought up the river from the Muscle

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Shoals Canal and the river bed was examined for foundations for the lock and dam at Kellys bar, 22 miles below Chattanooga; Savannah Towhead, 21 miles below Chattanooga, and Hales bar, 33 miles below Chattanooga. Soundings with a rod appeared to indicate bed rock near the surface both at Kellys bar and at Savannah Towhead, but with some difficulty the dredge succeeded in breaking through the top crust of cemented gravel and bowlders, and then steel rods were driven down as much as 30 feet below low water without finding any bed rock at either of these places.

Finally, at Hales bar, however, more favorable results were obtained, the dredge dipper reaching bed rock in places and steel-rod soundings apparently locating it elsewhere, so that bed rock is believed to lie about 6 feet under low water at the lock site and from 6 to 25 feet at the dam site.

This work was much impeded and its cost increased by the high stages of the river that interrupted it from time to time. It was completed, as far as available funds would permit, on March 21. Since then work has been in progress on plans and specifications for a lock and dam at this site, placing the crest of the dam at 635 and giving the lock a maximum lift of 37 feet. There are certain features, however, relating to the power-house end of the work that are not yet determined, so that it has not been practicable to complete the plans and submit them for approval.

The above operations were conducted under an allotment of $6,000 from the appropriation for examinations, surveys, and contingencies of rivers and harbors. A money statement for this allotment which was made June 23, 1904, is given below, and a separate statement is made for the appropriation for the lock and dam.

It is proposed to apply the balance available for this work and the additional appropriation recommended to the construction of the lock gates, ironwork, and machinery, and to the supervision of the work to be done by the private parties.

Money statements.

EXAMINATIONS, SURVEYS, AND CONTINGENCIES OF RIVERS AND HARBORS.

July 1, 1904, balance unexpended	$6,000.00
June 30, 1905, amount expended during fiscal year	6,000.00

LOCK AND DAM NEAR CHATTANOOGA.

Amount appropriated by river and harbor act approved March 3, 1905	$10,000.00
July 1, 1905, balance unexpended	10,000.00
Amount (estimated) required for completion of existing project	102,970.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	102,970.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

APPROPRIATION.

Hales bar lock and dam.

March 3, 1905	$10,000

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(C) OPEN-CHANNEL WORK.

Sweetwater bar.—The balance of the allotments from the emergency river and harbor acts of June 6, 1900, and June 13, 1902, available at the beginning of the fiscal year for dredging at Sweetwater bar, about 1 mile above Florence, Ala., was $6,546.03. Before work could be undertaken it was necessary to make extensive repairs to the dredging plant, consisting of the dredge *Kentucky*, steamer *Lookout*, 3 dump scows, 2 barges, and 1 quarter boat. These repairs were made at Lock 6, Muscle Shoals Canal. The principal items of repairs are given in the report of Assistant Engineer W. S. Winn on operations at the Muscle Shoals Canal. The total cost of repairs was $5,991.63. Of this amount $3,252.58 were charged to Sweetwater bar, $2,563.99 to the allotment for dredging at Rockport bar and Beech Creek Island, and $175.06 to the appropriation for improving Tennessee River below Riverton.

A new survey of Sweetwater bar was made in November, 1904, which developed considerable changes since work was discontinued about two years ago. A rock revetment on Pattons Island, nearly opposite the mouth of Sweetwater Creek, had been cut off from the shore line by the caving of the adjacent bank, and the resulting channel was very crooked. In March, 1905, the dredge *Kentucky*, with its attendant plant, was brought to this locality from Hales bar, where it had been used in examining the foundations for the proposed lock and dam near Chattanooga. The material of the old rock revetment was dredged and cast over against the island shore, and upon this was placed the gravel dredged from the channel, amounting to about 10,600 cubic yards. A channel 5 feet deep at low water was obtained through the bar at a cost of $2,546.85. Some additional work remains to be done in distributing the dredged material, and the unexpended balance, $746.50, can be judiciously used for this purpose and in maintaining the channel at this place.

It is proposed to apply the balance available for this work, and the additional appropriation recommended, to the improvement of the shoals between Hobbs Island and Guntersville and the maintenance of the channel.

Money statement.

July 1, 1904, balance unexpended	$12,664.79
Amount appropriated by river and harbor act approved March 3, 1905	15,000.00
Proceeds of sales of condemned property and property transferred	786.78
	28,451.57
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	5,908.53
July 1, 1905, balance unexpended	22,543.04
July 1, 1905, outstanding liabilities	5,966.28
July 1, 1905, balance available	16,576.76
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	10,000.00

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APPROPRIATIONS.

Open-channel work and Muscle Shoals improvement. [a]

March 2, 1827 (survey)	$200.00	June 3, 1896	$50,000.00
June 9, 1860 (claim)	1,350.00	March 3, 1899	35,000.00
July 25, 1868	85,000.00	March 23, 1903 (emergency river and harbor act)	6,000.00
April 10, 1869	5,095.00	June 7, 1904 (emergency river and harbor act)	3,600.00
July 11, 1870	45,000.00	March 3, 1905	15,000.00
June 10, 1872	50,000.00	Total	3,788,745.00
March 3, 1873	100,000.00	Received on account of transfer settlement	3.91
June 23, 1874	100,000.00	July, 1903, proceeds of sales of condemned property	34.91
March 3, 1875	360,000.00	August, 1904, proceeds of sales of condemned property	336.78
August 14, 1876	255,000.00	November, 1904, received on account of transfer of launch	450.00
June 18, 1878	300,000.00	Total	3,789,570.60
March 3, 1879	210,000.00		
June 14, 1880	300,000.00		
March 3, 1881	250,000.00		
August 2, 1882	250,000.00		
July 5, 1884	350,000.00		
August 5, 1886	262,500.00		
August 11, 1888	250,000.00		
September 19, 1890	300,000.00		
July 13, 1892	175,000.00		
August 18, 1894	30,000.00		

ABSTRACT OF CONTRACT WITH SHERIDAN-KIRK CONTRACT COMPANY, OF CHARLESTON, W. VA., FOR BUILDING SECTION OF COLBERT SHOALS CANAL.

Contract dated May 5, 1903, approved May 16, 1903. Supplemental contracts dated December 14, 1903 (approved December 30, 1903), and September 29, 1904 (approved October 8, 1904), respectively.

Date of beginning work, June 20, 1903; date of expiration, September 20, 1905.

Concrete, $8.28 per cubic yard; earth excavation, 50 cents per cubic yard; rock excavation, $1.98 and $2.33 per cubic yard; iron and steel, 7 cents per pound; laying masonry, $6 per cubic yard; riprap, $2 per cubic yard; stone backing, $10 per cubic yard; stone coping, $24 per cubic yard; face stone, $16 per cubic yard; special stone, $24 per cubic yard; timber, $50 per 1,000 feet B. M.; test holes, 60 cents per linear foot; additional cofferdam required for a portion of the rock-fill dam under supplemental contract, $2.50 per linear foot.

MODIFICATION OF PROJECT FOR IMPROVEMENT OF COLBERT SHOALS CANAL, TENNESSEE RIVER.

LETTER OF CAPT. W. J. BARDEN, CORPS OF ENGINEERS.

ENGINEER OFFICE, U. S. ARMY,
Chattanooga, Tenn., May 26, 1904.

GENERAL: (1) I have the honor to submit the following memorandum of certain proposed changes in the present plan for the Colbert Shoals Canal below the point to which the work will be carried by the present contract.

(2) The subjects covered have been under consideration for a considerable time, but their presentation to the Department was delayed for the purpose of allowing further study and more detailed estimates.

[a] The sum of $3,191,726.50 was expended from these appropriations for the Muscle Shoals improvement.

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Believing that the matter is of sufficient importance to require that it be brought to the attention of the Chief of Engineers, I present it now, in view of my impending change of station, and respectfully suggest that it be referred to my successor for his consideration and recommendation.

(3) As there are at present no funds available for the work referred to, an immediate decision in the matter is not essential, except that, if additional lands are to be purchased, it will be well to begin the negotiations therefor at as early a date as practicable.

ELIMINATION OF GUARD LOCK, AND RAISING WEIRS FROM ELEVATION 34 TO 41 AND LIFT LOCK WALLS AND GATES FROM ELEVATION 37.5 TO 42.

(4) This change was suggested by Mr. J. M. G. Watt, United States assistant engineer, in a memorandum from which the following is quoted:

(1) On September 11, 1902, the then approved project for the Colbert Shoals Canal contemplated a canal trunk 7.8 miles long, having at its lower end a lift lock and at its upper end a guard lock. The crest of the river embankment was to slope from the top of the lock wall of the upper lock almost regularly to that of the lock wall of the lower lock; near the lower end of this embankment was to be a waste weir, and at intervals along the embankment were to be filling weirs. The crest of the waste weir was to be at elevation 33.5, and the crest of the downstream filling weir was to be about elevation 36; the succeeding ones being increasingly higher until the upstream one was reached, and this was to be about elevation 47.

(2) This project had been approved by the Chief of Engineers, October 5, 1901, but subsequently to that date Major Knight, in order to avoid scour of the canal trunk due to velocity of rain-water discharge, contemplated putting in a wasteweir at each of the larger branches, with three or four others. Their crests were to be at elevation 34, and they would act both as wasteweirs for storm-water drainage and as filling weirs for gradually raising the canal level as the river rose. This proposed alteration was never made the subject of correspondence with the Chief of Engineers, consequently the approved project was the one above given.

(3) On September 11, 1902, I suggested to Major Knight that the guard lock be omitted, a proposition which he took up and submitted to the Chief of Engineers on September 17, 1902. In this plan there were to be weirs—combined waste and filling—with crests at elevation 34, one about a mile long at the bluff and one at each of the five larger branches below it.

(4) This plan was made the subject of consideration by a board of officers of the Corps of Engineers, who reported under date of October 23, 1902, that "the guard lock should not be eliminated from the canal." Their reasons given were that the elevation of the proposed weir 1 mile long was the same as the low-water surface of the canal (this weir was the upstream one and was from about Bevis Branch to Shades Branch—the lower ones were not mentioned), and that "there would exist in the canal a current as soon as the river commences to rise above low water;" and that at the 7-foot stage—when, however, open-river navigation would be preferred—between the head of the canal and the lower end of this weir "there would probably exist a fall in the water surface of as much as, if not more than, 2 feet per mile. This would give rise to currents in the upper end of the canal that would make navigation difficult, and the draw of the water to and over the long weir in question would make such navigation dangerous."

(5) There was no proposal on my part to place the weirs at a greater elevation than 34, nor do I think that Major Knight had that idea, and as there was no hint of it in the proposed plan I doubt if it occurred to the Board of Engineers to consider it. After the Board submitted their report and a copy was received here, it occurred to me that it would still be practicable to eliminate the guard lock by raising the weirs to elevation 41, and also raising the walls and gates of the lift lock 4 feet (to elevation 41.5). Then for any stage of the river up to a 7-foot stage (elevation 41 at head of shoals), when open-river navigation would be resumed, there would be no current from the river in the canal, thus overcoming the objections raised by the Board.

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(6) I have the honor to submit some remarks and figures with a view of showing that the guard lock may yet be eliminated, together with the cost of such parts of the work as will differ from the cost of the same under the present approved project. It is assumed that the upstream section of the canal, now under construction and extending to Shades Branch, will remain as now designed—that is, with the top of its wall at elevation 42 from head of shoals to about Bevis Branch, and at elevation 41 from Bevis Branch to Shades Branch; that in the lower section the embankment, where in fill, will be at least at elevation 43, with weirs at elevation 41 at each of the following branches: Boone, Ross, Hayes, Bledsoe, and Chickasaw, and that the lock walls and gates of the lift lock will be at elevation 42.

(7) Up to a 7-foot stage, elevation 41 at head of shoals, the canal will be a pond. At elevation 42 the water from the head to Bevis Branch will be flush with the wall; at Bevis Branch and below it will pour over the wall in a sheet of gradually diminishing depth, the river at this stage being probably 1 foot below the top of the wall at Bevis Branch. At elevation 43 (9-foot stage) the wall will be submerged by the river from the head to a point about halfway toward Bevis Branch, where the river will be at elevation 32. The canal above this point will then be part of the open river; below this point it will be in the same condition as in the 7-foot stage, the river at Bevis Branch being probably just about flush with the wall and at Shades Branch about 1.4 feet below it.

(8) At elevation 45.6 (11.6-foot stage) the whole wall will be submerged by the river, being covered 1.5 feet at Shades Branch; at elevation 44.5 (10.5-foot stage), the river will cover the whole wall and probably be just flush with the top at Shades Branch, i. e., elevation 41; so that, as far as the lower section of the canal is concerned, from Shades Branch to the lift lock, up to a 10.5-foot stage, the water will be no higher than elevation 41.

(9) At the 11.6-foot stage the water at the head of the lower section of the canal (Shades Branch) is at elevation 42.5; that is to say, it is 18 inches higher than the tops of the weirs. It is probable that all this volume of water—the sectional area of which between elevations 42.5 and 41 is, in the canal proper, 253.5 square feet—would pass over the first two weirs, neither being submerged by the outside river.

(10) At the 13.1-foot stage the river at Shades Branch would be at elevation 44.5, and would be above all the weirs except the last one (Chickasaw). It is probable that the canal would have the same slope as the river, as far, at least, as Bledsoe Branch weir. In fact, the weirs would, I think, make it practically a part of the open river. The water in the river at Hayes's would be elevation 42.2, and in the canal the same; at Bledsoe Branch it would be elevation 41.3 in the river and probably the same in the canal, that is, 0.3 foot deep on this weir. From this point to the lock it would be about the same elevation, and would discharge over Chickasaw Branch weir.

(11) The following table, compiled from profile of Mr. Winn, accompanying his letter of July 15, 1901, shows the elevations of the river at different points for several stages:

Stage upper gauge.....feet..	7.0	9.5	11.6	13.1	14.6
	Elevation.				
Head of shoals	41.0	43.5	45.6	47.1	48.6
Bevis Branch	38.3	41.4	43.8	45.6	47.4
Shades Branch	37.5	39.6	42.5	44.5	46.5
Boone Branch	33.5	37.5	40.7	43.0	45.4
Ross Branch	32.7	37.2	40.3	42.7	45.0
Hayes Branch	32.0	36.6	39.8	42.2	44.6
Bledsoe Branch	30.5	35.0	38.5	41.3	43.5
Chickasaw Branch	29.6	34.0	37.8	40.4	42.8
Lift lock	29.0	33.5	37.5	40.0	42.6

(12) To raise the walls and gates of the lift lock 4 feet (or preferably 4.5 feet, in order to use stone already on hand) would not increase the maximum lift. The table below gives the elevations of the water in the canal for the present and for the suggested plan, and the elevations of the river for the same stages, compiled from hydrographs. It will be seen that the maximum lift, 26 feet, is not increased, but that the maximum head on the upper gate is increased from 8 to 13 feet.

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Stage, upper gauge.....feet..	{l. w. / 0.0}	3.0	5.0	7.0	9.5	11.6	13.8
	Elevation.						
Head of shoals	34.0	37.0	39.0	41.0	43.5	45.6	47.8
Canal, lower end, present plan	34.0	34.0	34.0	34.0	34.0	37.5	41.5
Canal, lower end, proposed plan	34.0	37.0	39.0	41.0	41.0	41.0	41.5
River at lift lock	8.0	16.0	23.0	29.0	33.5	37.5	41.5
	Feet.						
Head on upper gate, present plan	8.0	8.0	8.0	5.0	.0	.0	.0
Head on upper gate, proposed plan	8.0	11.0	13.0	12.0	7.5	3.5	.0
Head on lower gate, present plan	26.0	18.0	11.0	5.0	.5	.0	.0
Head on lower gate, proposed plan	26.0	21.0	16.0	12.0	7.5	3.5	.0

NOTE.—Elevation of lower miter sill is 1.25 and of upper sill 26.25; they are assumed as 1 and 26, respectively, in the above table. Elevation of lock walls and of gates in present plan is 37.5; in proposed plan, 42.

(13) Since the branches are to discharge into the canal in both the present and proposed plans, it is evident that such portions of their banks on south side of canal as lie below the canal elevation will be submerged. This elevation is 34 for the present plan and 41 for the proposed. The land below 34 is valueless for agriculture; that above about 37 is valuable, and, being submerged, it is pretty certain that claims for damages would be made, and it would be cheaper to purchase the land beforehand. The area of the land flooded between the south line of the United States land and the hills, at elevation 34 and elevation 41, is as follows:

	Elevation 34.	Elevation 41.
	Acres.	*Acres.*
Above Boones Branch	0.00	0.00
Boones Branch	.07	3.29
Ross Branch	.09	4.64
Hayes Branch	.00	.00
Bledsoes Branch	.08	2.23
Chickasaw Branch	.90	3.47
Total	1.14	13.63

Excess, 12.21 acres.

(14) No land on the north side of the United States land, between the canal and the river, has been taken into account since the side walls or banks of the weirs will confine the discharge and not permit it to overflow the adjacent arable lands.

(15) The five weirs at the outlets of the branches being, under the proposed plan, at a height 7 feet greater than under the present plan, would necessitate longer slopes, which means a greater amount of paving.

(16) The proposed plan will cut out from the present plan the cost of the guard lock complete, with its lock keepers' dwellings and other buildings, and will also lessen the cost of salaries and maintenance, in that lock keepers will be required at the Riverton lock only. It will add to the present plan the cost of the extra masonry and height of gates for lift lock, extra paving for weirs, and extra land on south bank. This is given below:

Cost of guard lock, as estimated in my report of January 12, 1903, $134,000. Deduct for 1,200 feet of lower approach wall, which is included in above and will be necessary in either plan, and for excavating for it, $49,000, and add for gates and machinery $25,000; this leaves as net cost of lock $110,000. Cost of buildings, say $5,000. Total, $115,000.

(17) It is desired to use the stone now on hand at Keller Quarry. The area of the top of the lift lock, both walls, is 11,660 square feet; the thickness of the coping is 2 feet, consequently, there will be required 23,320 cubic feet of coping, or 863 cubic yards, for the lock walls as far as the lower end of the lock proper. It would be advisable to raise the lower approach walls 2 feet for a distance of, say, 100 feet; this would all be coping and would amount to 73 cubic yards, making the total coping required 937 cubic yards. The amount of face stone, 2½ feet thick, will be about 1,200 linear feet, or about 450 cubic yards; the amount of backing of the same thickness will be about 630 cubic yards, a total for the three classes of masonry of 2,017 cubic

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yards. There are on hand 201 cubic yards of coping, 385 cubic yards of face stone, and plenty of backing. This leaves to be supplied 736 cubic yards of coping and 65 cubic yards of face stone. To transport from Keller Quarry and lay in the wall will cost $7.50 per cubic yard; to cut coping from stone already quarried will cost $16 per cubic yard, and to cut face stone, $8.

Cost of cutting 736 cubic yards of coping, at $16	$11,776
Cost of cutting 65 cubic yards of face stone, at $8	520
Cost of transporting and laying 2,017 cubic yards of masonry, at $7.50	15,127
Cost of 4½ feet extra height of gates, say	5,000
Cost of extra land, 12.21 acres, say	1,700
Cost of extra paving on weirs, 1,500 cubic yards, at $2.50	3,700
Total	37,823
Proposed plan, decreased cost	115,000
Proposed plan increased cost	37,800
Net decrease (saving in first cost)	77,200

(5) I see no serious objection to the changes above suggested. With the modifications now proposed there will be no currents in the canal, except due to storm-water drainage, up to the 7-foot stage in the river (elevation 41), and above this stage navigation under the present plan is to be in the open river.

(6) The only expressed objection of the Board of Engineers to the elimination of the guard lock was that—

> There would exist in the canal a current as soon as the river commences to rise above low water—

this current, and especially the draw over the long weir, being considered dangerous to navigation. That this was the only objection seems further emphasized by the following sentence of the report:

> A guard lock would prevent any flow in the canal until the river should rise to a stage that would permit outside navigation.

The proposed plan overcomes these objections.

(7) I do not consider that the currents due to storm-water drainage would be serious obstacles to navigation or would cause dangerous scour in the canal trunk. The question of the velocity due to storm-water drainage was discussed at length in Mr. Winn's report of July 15, 1901, to Major Knight, forwarded with Major Knight's report of September 5, 1901. In the present scheme, at all stages less than 7 feet (elevation 41), the discharge will be upstream, unless sufficient in amount to raise the water surface in the canal above 41, when it would flow over the weirs. At the 7-foot stage and above, the discharge of course will be directly across the weirs.

(8) Assuming that the stability of the lock walls when raised 4½ feet will be sufficient under all circumstances, the desirability of the proposed changes will, in my opinion, be measured solely by the amount of the saving to be effected. Should more careful studies show that this saving will be as large as that above estimated, $77,200, I think the change should be made, especially having in view the additional annual saving due to cost of maintenance of the guard lock.

* * * * * * *

Very respectfully, etc.,

W. J. BARDEN,
Captain, Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

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LETTER OF MAJ. H. C. NEWCOMER, CORPS OF ENGINEERS.

ENGINEER OFFICE, U. S. ARMY,
Chattanooga, Tenn., October 22, 1904.

GENERAL: (1) Referring to Captain Barden's letter of May 26, 1904, in which he suggests certain changes in the approved project for the Colbert Shoals Canal, I have the honor to submit the following report on the proposed elimination of the guard lock and raising the weirs from elevation 34 to 41 and the lift-lock walls and gates from elevation 37.5 to 42.

(2) The history of the project for this work is briefly as follows:

On November 28, 1890, the Secretary of War approved the project submitted by a board of engineers, providing for a lateral canal on south bank of river, 150 feet wide, 7 feet deep, and about 7.8 miles long, having at its lower end a combined lock with total maximum lift of 25 feet, and at its head a guard lock, the trunk of the canal being separated from the river by an embankment resting mainly on the river bank, but partly in the river, and of sufficient height to exclude all flood water from the canal, which was to be available for use at all stages of the river. In 1891 two locks, having lifts of 12 and 13 feet, respectively, and separated by a pool 1 mile long, were substituted for the combined lift lock. In 1892 a single lock with lift of 25 feet was substituted for these two locks, and the masonry of this lock and its approaches has been built, but the maximum lift at low water is found to be about 26 feet.

In 1897 there was a local flood that surpassed the highest former stage by about 2.5 feet, indicating the necessity of increasing the height of the guard lock and of the canal embankment. The resulting increase in estimated cost of the work led to several studies of modifications having for their object a reduction of cost without material decrease of utility.

In 1901 the project was modified by reducing the height of the guard lock and of the canal embankment, with a view of using the canal only during the lower stages of the river until there should be a depth of at least 7 feet in the open channel, which would then provide easy navigation.

Finally, on February 17, 1903, the Secretary of War approved further changes, of which the chief ones were to move the guard lock from its proposed position at the head of the canal to a point about 12,000 feet downstream, and to build the canal trunk above the guard lock in the river bed, skirting the bank, and separated from the river by a concrete wall.

A contract with the Sheridan-Kirk Contract Company is now in progress for the excavation of this upper portion of the canal trunk and the construction of the river wall, with the provision that a rock-fill dam made of the excavated material, with a light toe wall of concrete, shall take the place of the upper end of the river wall for a distance of about 5,500 feet.

(3) The existing project, resulting from the various changes, provides for a lateral canal about 8 miles long, 7 feet deep (6 feet on lower miter sill), generally 108 feet wide on bottom (136 feet wide at low-water surface, elevation 33.5), with a lift lock 80 by 350 feet at lower end of canal, having a maximum lift at low water of 26 feet,

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with tops of lock walls and gates at elevation 37.5, with a guard lock 80 by 350 feet, about 2.3 miles below the head of the canal, with tops of lock walls and gates at elevation 43, the canal above the guard lock being excavated in the river bed (about 180 feet wide at bottom and 200 feet wide at elevation 33.5) and separated from the river by a rock-fill dam and concrete wall with top at elevation 42 at upper end and elevation 41 for about 5,533 feet above the lock, the canal between the two locks to be excavated mainly in the river bank, with top of embankment on river side at or above the stage of 11.6 feet (at which the lower lock is drowned out), except at the five waste weirs, which have their crests at elevation 34 and are located opposite the principal waterways discharging into the canal, the most of the excavated material to be placed in an embankment on the land side of the canal.

(4) Captain Barden now proposes to eliminate the guard lock and raise the walls and gates of lift lock 4.5 feet, to elevation 42, and to build the waste weirs to elevation 41, shifting the canal trunk toward the land side of the canal right of way and wasting the excavated material on the river side, where land is now being purchased, so as to permit the most economical disposition of such material. The accompanying blueprint gives two profiles of the canal, one according to the approved project and one according to the proposed project.

(5) A discussion of the proposed changes is given quite fully in the report of Assistant Engineer J. M. G. Watt, as quoted in Captain Barden's letter (see accompanying extract relating to these changes), and has been carefully considered by me. It is estimated that the changes would save about $77,000 in original construction of the canal and would materially reduce the annual cost of operation and maintenance on account of omitting one lock with its attendants. The changes are therefore advisable if they can be made without impairing the efficiency of the canal.

(6) The critical considerations as to the practicability of the changes and the resulting efficiency of the work appear to be the following:

(*a*) The stability of the lift lock structure with the added height of 4.5 feet.

(*b*) The effects of the storm drainage from the waterways that discharge into the canal.

(*c*) The effect of omitting the guard lock upon the control of drift and flood deposits in the canal.

(7) The stability of the lift lock with increased height has been investigated, with satisfactory results. The present lock walls are unusually massive, having a thickness at base of 21.5 feet for a height of 33.5 feet. After raising the walls 4.5 feet the base would be about 56 per cent of the height, and the factor of safety against overturning is estimated to be 4.22, including the moment of the vertical load of earth on the bank of the wall, or 1.64 disregarding this load. The gates and maneuvering appliances have not yet been designed and can be readily adapted to the increased height.

(8) The storm drainage is provided for below the guard lock in the existing project by five waste weirs at elevation 34, placed opposite the principal waterways. Above the guard lock the discharge will be upstream in the canal at stages under 7 feet. Under the proposed change the entire discharge would be upstream as long as water level in canal is below elevation 41. This storm drainage is discussed at length

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in Exhibit E accompanying Major Kingman's report of August 2, 1899, and again in Mr. Winn's report accompanying Major Knight's report of September 5, 1901. The entire drainage area includes about 9,463 acres, with average fall or slope of about 20 feet in 1,000 feet. Using the Burkli-Ziegler formula for run-off, $Q = CRA\frac{3}{4}S\frac{1}{4}$, with value of 0.5 for C and $R=3$, a maximum discharge of about 3,050 cubic feet per second was estimated. But this value of C is plainly excessive, as it is usually assumed to be 0.25 for purely rural districts, and with this correction the discharge becomes about 1,525 cubic feet per second, giving an average velocity of less than 2 feet per second in the minimum water section of 854 square feet. No evil results of any moment are anticipated from this source, the side slopes of 1 on 2 being paved from the bottom up.

(9) The question of drift and flood deposits remains to be considered. The presence of a guard lock would doubtless tend to lessen any trouble from these sources, but in order to have any practical efficiency for this purpose it should be placed at the head of the canal instead of about 2.3 miles below, as it is in the present project. Little trouble is anticipated from drift in any case, since the channel opposite the head of the canal is near the right bank. On the other hand, the flood waters of the river will have free access to the canal, under the present project, for more than one-fourth of its length at all stages—and this at the upper end, where the principal deposits are to be expected—and will enter the reach between the two locks at all stages above that of 7 feet at the head of the canal, where the highest stage has been 30.2 feet. My conclusion, therefore, under this head is that with either plan there may be some trouble from drift, and that there will certainly be flood deposits requiring periodical removal; but that the omission of the guard lock will have no marked effect on either source of trouble.

(10) It is therefore recommended that the existing project be modified, as proposed, by eliminating the guard lock and raising the weirs from El. 34 to 41 and the lift-lock walls and gates from El. 37.5 to 42.

Very respectfully, your obedient servant,

H. C. NEWCOMER,
Major, Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.
(Through the Division Engineer.)

[First indorsement.]

ENGINEER OFFICE, U. S. ARMY, CENTRAL DIVISION,
Cincinnati, Ohio, October 28, 1904.

(1) Respectfully forwarded to the Chief of Engineers, United States Army.

(2) After careful consideration of the within report in connection with previous ones relating to this improvement, I concur in Major Newcomer's recommendation that the existing project be modified as indicated in paragraph 10 within.

G. J. LYDECKER,
Col., Corps of Engineers, U. S. Army,
Division Engineer, Central Division.

* * * * * *

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WRAPPER.

[First indorsement.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, March 21, 1905.

Respectfully referred to Lieut. Col. W. H. Bixby, Corps of Engineers, for consideration and report by the Board constituted by Special Orders, No. 11, current series, from the Office of the Chief of Engineers.

To be returned.

By command of Brig. Gen. Mackenzie:

H. F. HODGES,
Major, Corps of Engineers.

[Second indorsement.]

FLORENCE, ALA., *April 28, 1905.*

Respectfully returned to the Chief of Engineers, United States Army, with report, as called for by first indorsement.

WM. H. BIXBY,
Lieut. Col., Corps of Engineers.

[Sixth indorsement.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, June 10, 1905.

(1) Respectfully submitted to the Secretary of War.

(2) The present project for the improvement of the Tennessee River includes the construction of a lateral canal to overcome the Colbert and Bee Tree shoals, which lie between Florence and Riverton, Ala. The plan for it was devised originally by a Board of Engineer officers in 1890, and provides for a canal about 8 miles long, having at its lower end a lift lock and at its upper end a guard lock. This plan received the approval of the Assistant Secretary of War under date of November 28, 1890. Under date of February 3, 1903, the Secretary of War authorized a modification of this plan, moving the guard lock from its proposed position at the head of the canal to a point about 13,000 feet farther down, and shifting the canal trunk, from the new position of the guard lock to the head, to a position in the bed of the river, separated from the river itself by a wall.

(3) In 1904 the district officer, Capt. W. J. Barden, Corps of Engineers, submitted a memorandum recommending certain alterations in the adopted plan for the canal. His successor, Maj. H. C. Newcomer, Corps of Engineers, proposed later on substantially the same changes. A Board of officers of the Corps of Engineers, consisting of Lieut. Col. W. H. Bixby, Maj. Geo. A. Zinn, and Capt. Harry Burgess, was appointed from this Office to investigate these proposed changes and report thereon, and it has submitted the accompanying report.

(4) The changes proposed are to eliminate the guard lock altogether, to raise the walls and gates of the lift lock, to raise the weir crests, to shift the canal trunk toward the land side of the canal right of way, and to raise the river embankment. The elevations selected for all the

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parts are such that the bank, weirs, and lift lock will remain submerged, and the canal and lock will remain in operation until the river has reached at least a 7-foot stage, at which time the canal can be closed and boats can safely navigate the open river from the head to the foot of the shoals. The proposed modification will effect a total saving of about $150,000. The arguments for and against the changes now proposed are given at length in the Board's report. The Board concurs with the district officers mentioned above in recommending the adoption of these changes.

(5) The law under which the work is now proceeding provides simply for a lateral canal around the Colbert and Bee Tree shoals, and does not bind the War Department to any specific plan for the work. It is therefore, I think, within the province of the Secretary of War to authorize such changes in the project as he may deem advisable.

(6) I recommend that the modification proposed by Captain Barden and Major Newcomer, and recommended by the Board in its accompanying report, be authorized.

A. MACKENZIE,
Brig. Gen., Chief of Engineers, U. S. Army.

[Seventh indorsement.]

WAR DEPARTMENT, *June 12, 1905.*

Approved as recommended by the Chief of Engineers in the preceding indorsement.

ROBERT SHAW OLIVER,
Acting Secretary of War.

REPORT OF BOARD OF ENGINEERS.

FLORENCE, *Ala., April 28, 1905.*

GENERAL: (1) The Board of Officers of the Corps of Engineers constituted by Special Orders, No. 11, War Department, Office of the Chief of Engineers, Washington, March 20, 1905, "to consider and report upon proposed modification of the project for improving Tennessee River at Colbert and Bee Tree Shoals," has the honor to submit the following report:

(2) The Board assembled, upon call of the senior member, on the U. S. E. D. steamer *Colbert*, at Chattanooga, Tenn., at 10 a. m., April 25, 1905, and proceeded by this boat by river to the site of the proposed improvement. During the trip down the river, on April 25, 26, and 27, an examination was made of all data from the files of the United States Engineer Office at Chattanooga relating to the subject under consideration, and of the visible effects of freshets upon exposed banks between high and low water, as well as of the distribution, extent, and quality of drift piles; and on April 27 an examination was made of the site of the proposed canal. The Board finally adjourned on April 28, 1905.

(3) *History of projects.*—(*a*) The first plan for improving Tennessee River at Colbert and Bee Tree shoals by locks was that of Lieutenant Colonel Barlow in 1888. He proposed a fixed dam with lock at the foot of Colbert shoals, of 14½ feet lift, and another dam and lock of 12 feet lift at the foot of Bee Tree shoals.

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(*b*) In 1889, after a further survey, Colonel Barlow proposed longitudinal dams and two lateral canals with locks for low-water navigation. This plan was considered by a Board of Engineer Officers, whose recommendation (approved by the Secretary of War November 28, 1890) was for one lateral canal, in the south bank of the river, 150 feet wide at water surface, 7 feet deep, and about 7.8 miles long, having a combined lock of 25 feet maximum lift at the lower end, and a guard lock at the upper end. The trunk of the canal was to be separated from the river by an embankment (1 foot above highest flood level) of sufficient height to exclude all flood water from the canal, making it available for use at all stages of the river. The locks were to be 80 by 350 feet, with 6 feet depth on sills.

(*c*) In 1891 two locks, having lifts of 12 and 13 feet, respectively, and separated by a pool 1 mile long, were substituted for the combined lock at the lower end of the canal, still retaining the guard lock at the upper end.

(*d*) In 1892 the project was again modified by the substitution of one lock of 26 feet lift for these two lower locks, still retaining the upper (guard) lock.

(*e*) In 1897 a flood occurred which was 2½ feet higher than any previously recorded and 1½ feet above the crest of the embankment as projected. Major Kingman then considered it necessary to raise the crest of the embankment 3 feet above the level of this flood, but finding such construction very expensive he, in 1899, proposed to abandon the lateral canal and substitute two locks and cross dams in the river. This project was considered by a Board of Engineer officers, which reported in favor of continuing the then existing (1892) project. In arranging the details of this project the crest of the embankment was planned at 3 feet above the 1897 flood plane. The small streams or branches emptying into the river between the upper and lower ends of the canal were to be provided for as follows: The eight smaller branches were to discharge into the canal, while the larger, five in number, were to be passed by culverts under the bed of the canal. The canal was designed to be navigable at all stages of the river, the lift lock to be in service at all stages of the river below about 12 feet at the head of the canal, or until the lift lock be drowned out, and the guard lock to be in service as a lift lock for all stages of the river above 3 feet at the head of the canal.

(*f*) On account of the large increase in the estimate of cost, caused by the modifications made necessary by the flood of 1897, Major Knight, in 1901, proposed to limit the embankments and levees to such height as would insure the canal being available for use until the river attained a stage at which open-river navigation is possible. He also proposed to eliminate the culverts under the canal, letting all the creeks discharge into the canal and over a waste weir near the lift lock, and to provide filling weirs by which the water in the canal would gradually assume the slope of the river when the latter was at stages exceeding about 10 feet. This modification was approved October 5, 1901. Under this plan the canal was to be used only at stages below about 10 feet at the head of the shoals (water surface at elevation 44), boats being able to readily use the open river at all higher stages, and, if desired, even at the 7-foot stage.

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(*g*) In September, 1902, Major Knight proposed to eliminate the guard lock and to place the five weirs at elevation 34, or 0.5 foot above low-water surface at the head of canal. A Board of Engineers considered this proposal, but recommended that the guard lock should be retained, the main objections given being the expected difficulties from currents in the canal, and dangers from draw toward and over the weirs at stages above low water while the canal was in use.

(*h*) In December, 1902, Major Knight recommended transferring the canal to the river from Shades Branch to head of shoals, and transferring the guard lock to Shades Branch, retaining the location in the bank for the section from Shades Branch to the lift lock; the canal to be 108 feet wide on bottom, with side slopes of 1 on 2 paved from bottom to top and with five waste weirs at elevation 34. The upper section of the canal was to be separated from the river by a concrete wall. This was approved by the Secretary of War February 17, 1903.

(*i*) In 1904 a rock-fill dam with concrete toe wall was substituted for a portion of the concrete wall separating the upper section of the canal from the river.

(4) *Present project as revised.*—The net result of the various changes indicated above leaves the following as the project for this improvement:

A lateral canal about 8 miles long, from near the head of Colbert shoals to the foot of Bee Tree shoals, to be 7 feet deep at low water, below guard lock to be 108 feet wide at bottom, 136 feet wide at the low-water surface (elevation 33.5), with a lift lock 80 by 350 feet at lower end of canal having a maximum lift of 26 feet, with tops of lock walls and gates at elevation 37.5, and with a guard lock 80 by 350 feet near Shades Branch, 2.3 miles below the head of canal, with tops of lock walls and gates at elevation 43, the low-water depth on the sills of both locks being 6 feet. The canal above the guard lock is to be excavated in the river bed and separated from the river for about 6,000 feet by a rock-fill dam with toe wall of concrete, elevation of crest at least 42, and for about 6,300 feet by a concrete wall just above the guard lock, the greater length of this wall having its crest at elevation 41 and the rest at 42. The canal above the guard lock has a bottom width of 180 feet, and width at low-water surface (elevation 33.5) of 200 feet. The canal between the two locks is to be excavated in the river bank, with top of embankment on river side at or above the stage of 11.6 feet at the head of canal (at which stage the lower lock is drowned out), except at the five waste weirs, which are to have their crests at elevation 34 (0.5 foot above low water in the canal) and which are to be located opposite the principal waterways discharging into the canal; the excavated material to be placed in embankment along the sides of the canal.

(5) *Present condition of work.*—The masonry of the lower lock was completed in 1897, and entrance thereto in 1899. In 1903 a contract was entered into for the construction of the section above the guard lock. Under this contract most of the earth excavation and about 40 per cent of the rock excavation have been made; but the concrete is practically untouched, only 1,230 cubic yards having been placed out of an estimated total of 24,000 cubic yards required. This contract will complete the upper section of the canal nearly to the guard lock.

(6) *Proposed modification of the project.*—The modifications proposed by Captain Barden and Major Newcomer in 1904, and referred

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to this Board for report, are as follows: (1) To eliminate the guard lock; (2) to raise the walls and gates of the lift lock 4.5 feet to elevation 42 (8.5 feet above low water at the head of canal); (3) to raise the weir crests 7 feet to elevation 41; (4) to shift the canal trunk toward the land side of the canal right of way; and (5) to raise the river embankment to at least elevation 43, wasting the surplus excavated material on the river side of the canal where land has already been purchased for the latter purpose (authority Secretary of War, June 25, 1904).

(7) These elevations are such that the canal embankment, weirs, and lift lock will remain unsubmerged, and the canal and lock will remain in operation until the river has reached at least a 7-foot stage, at which time the canal can be closed and boats can safely navigate the open river from the head to the foot of the shoals. While the least height of the river embankment is shown on the blueprint at elevation 43, it is understood by the Board that the material excavated from the canal, piled on the natural ground (which now stands at average elevation of about 41 on the river side of the canal), will doubtless raise the river embankment considerably above the height shown on the blueprint, and probably to elevation 50 or more, which would place the top of the embankment above the adjoining river surface at an 18-foot stage.

(8) *Effect of proposed modifications on navigation of canal.*—Under the present approved project and at river stages below 7 feet the water in the river at the foot of the canal would be at elevations from 7.5 to 29.0, the lower lock raising boats from such levels to elevation 34.0, the level of the lower canal, and the upper or guard lock raising boats still higher from this level to that of the water at the head of the shoals, or to elevation 34.0 to 41.0, two lockages being required at all stages above zero. At some stage near to and above 7 feet the canal would go out of commission, because of the draw over the weir just above the guard lock. At higher stages boats will use the river.

In a canal constructed according to the proposed modifications the conditions for navigation will be the same as the above, except that the entire lift of 26 feet or less will be concentrated at the lower lock, the water in the trunk of the canal varying from elevations 34.0 to 41.0, corresponding to the river stages of 0 to 7 feet. The change, therefore, will reduce the time of passage of the canal and be to that extent an advantage.

(9) *Effect upon storm discharge.*—Under the present plan the branches discharge into the canal both above and below the guard lock. In the upper section the drainage will pass into the river through the upper end of the canal, while in the lower section it will pass over the weirs into the river when it reaches an elevation of 34.0.

Under the proposed changes the branches will discharge into the canal and into the river through its upper end, and over the weirs when the water in the canal reaches an elevation of 41.0.

From the data at hand the Board believes that the current produced in the canal by this discharge, under the proposed modifications, will seldom exceed 2 feet per second, even at the periods of greatest rainfall, and when exceeding this velocity that no damage to the slopes will occur.

Practically all detritus brought into the canal by these branches,

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under either plan, will be deposited in the canal or in catchment basins, and will in any event be small in amount.

(10) *Effect upon currents in canal.*—Under both plans, up to the 7-foot stage, there will be no current in the canal, except the slight current due to water entering the canal as river rises and the storm discharge currents referred to above. Under the existing plan the canal trunk below the guard lock will begin filling through the upstream weir soon after the river rises above the 7-foot stage, the other weirs coming into play successively as the river rises, the only currents below about an 11.6-foot stage being those produced by these weirs. At about the 11.6-foot stage (elevation 45.6) the gates of both locks will be submerged and the canal will be practically part of the open river. Under the modified plan between the stages of 7 and 10.5 feet, according to the calculations of Mr. Watt, the water between Shades Branch and the lift lock will remain at elevation 41.0; and hence up to the 10.5-foot stage there will be no current below Shades Branch except that due to the filling of the canal. At the 11.6-foot stage Mr. Watt computes that the first two weirs will pass the discharge, and that the canal below these two weirs will stand at elevation 41.0. At the 13.1-foot stage, according to Mr. Watt, the lowest weir will just begin discharging. The gates of the lock will not be submerged until about the 14-foot stage. If these calculations are correct (and they are probably close to the actual facts), the proposed changes will give less current in the canal below the 14-foot stage and will give no increase of current at higher stages. Under such circumstances danger from currents will be less with the guard lock omitted and the weirs raised. Under both plans, at high or freshet stages when locks and embankments are all submerged (occurring only at long intervals and for short periods of days, see table attached), the currents through the canal will be about the same. However, considering the great volume of material to be excavated, the river embankment—to be built from such material—will be of such large cross section that any wash along or across its top during occasional freshets is not expected to injure its efficiency.

(11) *Effect upon deposit and drift.*—By either plan the canal will receive deposits which will necessitate dredging. Practically all of this deposit will be at the ends of the canal. At stages below 7 feet the deposit in the canal will be very nearly the same for both plans; above 7 feet the modified plan will probably diminish the deposit.

Drift will ordinarily follow the opposite bank of the river and not enter the canal at all; but, under strong northerly winds, it may be blown over to the canal entrance and cause trouble. But such drift as does enter the canal will do so without regard to the presence or absence of the guard lock. Moreover, the small amount of drift observed along the river bank at and above the proposed improvement indicates but little future trouble for the canal from this cause; and should such trouble arise or be feared, it can be easily remedied by the construction, at any time, of small beartrap gates at either or both ends of the canal, of dimensions suited to the amount of drift to be taken care of.

(12) *Stability of lift lock walls with increased height.*—Under the present approved project, the walls of the lift lock are 21.5 feet thick at base and 33.5 feet high. Raising the walls 4.5 feet (to elevation 42) as proposed, the factor of safety against overturning is estimated by

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Mr. Watt at 4.22 including the weight of the earth on the back of the wall, or at 1.64 disregarding the weight of the earth on the back.

(13) *Saving effected by proposed modification.*—Taking the figures submitted by Captain Barden, the saving produced by the proposed change of location of canal will amount to 215,000 cubic yards of excavation, about 10 per cent of that yet to be done, originally estimated at 50 cents per cubic yard, or $107,500, and now estimated at about $50,000. This change of location is apparently advantageous in every way, now that the acquisition of the necessary land for wide embankments and spoil banks has been authorized.

The saving produced by the other modifications proposed, as estimated by Major Newcomer, will be about $100,000 on first cost, besides a certain quantity of stone on hand and an annual saving on cost of operation of $3,000. The saving which would be effected can not be determined more accurately than this by the Board; but this estimate is believed to be sufficiently accurate to show that there will be a very material saving.

(14) *Advantages of the proposed modifications.*—The following advantages will, it is believed, follow from modifying the project as proposed. Increased ease of navigation by avoiding lockages at the upper end of canal; decreased first cost of approximately $50,000 by reason of change of location, and of $100,000 by reason of other modifications; and decreased annual cost of operation of $3,000.

The only disadvantage due to the proposed changes appears to be that the elimination of the guard lock will prevent its use as a cofferdam for closing the canal against the upper river in case that some accident to the canal or its banks may require the canal to be drained. But in view of the large cross section of the embankments, the comparatively shallow draft of the canal, and the ease and slight cost of construction, under emergency, of a rock-fill cofferdam across the canal at any point, such disadvantage is not considered a serious one, and the use of a guard lock for such purpose alone is considered as far too expensive.

(15) *Recommendation.*—The Board therefore recommends that the existing project for improving Tennessee River at Colbert and Bee Tree Shoals be modified as indicated in paragraph 6 of this report.

Respectfully submitted.

W. H. BIXBY,
Lieut. Colonel, Corps of Engineers.
GEO. A. ZINN,
Major, Corps of Engineers.
H. BURGESS,
Captain, Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

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COLBERT SHOALS.

Table showing number of days each year (1892–1904, inclusive) that the river has been at or above the stages given.

Year.	Stage at Gauge No. 1.																	
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	20
1892	366	335	280	194	95	47	36	32	28	24	18	17	15	12	11	10	8	1
1893	365	343	193	128	88	52	39	39	24	20	15	12	10	8	8	4	....	....
1894	365	258	142	96	84	16	12	10	8	4	3	1	....	....	....	....	....	....
1895	365	285	204	123	59	28	20	16	9	4	2	....	....	....	....	....	....	....
1896	366	312	205	85	61	39	25	16	9	8	7	4	3	2	....	....	....	....
1897	365	272	181	132	86	64	50	45	37	33	28	24	20	17	16	16	14	10
1898	365	344	217	97	59	31	18	10	....	....	....	....	....	....	....	....	....	....
1899	365	228	180	147	93	75	58	58	42	29	26	24	22	20	19	13	13	4
1900	365	356	232	150	97	50	29	17	8	6	4	4	3	1	....	....	....	....
1901	365	365	282	190	108	80	65	57	41	27	6	5	4	....	....	....	....	....
1902	365	285	196	167	77	48	46	46	29	26	19	14	13	9	6	2	....	....
1903	365	267	204	132	96	75	63	58	47	36	30	20	5	2	....	....	....	....
1904	348	270	146	65	31	10	9	9	6	5	3	1	....	....	....	....	....	....
Total...	4,780	3,920	2,662	1,706	979	615	470	413	288	222	161	126	95	71	60	45	35	15
Average for 13 years....	364	302	204	131	75	47	36	32	22	17	12	10	7	6	5	4	3	1
Per cent.....	99.6	82.5	56.0	36.0	21.1	13.0	9.8	8.7	6	4.7	3.3	2.8	1.9	1.6	1.4	1.1	0.8	0.3

(3) BELOW RIVERTON, ALA. (226 MILES).

Prior to the appropriation of $30,000 made by act of March 3, 1905, for the Tennessee River below Riverton, in Tennessee, there were no funds available for work on this section, aside from the allotment of $6,200 which was made on June 7, 1904, from the emergency appropriation in the river and harbor act of June 13, 1902, for maintenance of channels at Rockport Bar and Beech Creek Island. This work could not be undertaken, however, before the present low-water season, and operations prior to May were therefore confined to repairs to dredging plant, as described under head of Sweetwater bar, between Chattanooga and Riverton.

In May, 1905, the dredge plant proceeded below Riverton, and as soon as the stage of water permitted it began operations at Cedar Creek bar, 141 miles above Paducah; this being one of the obstructions that gave most trouble during the last low-water season. By June 30 about 17,800 cubic yards had been dredged; this being about one-third of the amount required to form the proposed channel through the bar, having a length of 1,800 feet, width of about 200 feet, and minimum depth of 5 feet.

While the dredge plant was on its way down the river, a gauge was erected at Savannah, Tenn., at the request of the Weather Bureau.

It is proposed to apply the available balance and the additional appropriation recommended to continuing improvement by dredging—selecting first those shoals that offer the greatest hindrance to navigation—and to maintenance of the navigable channel.

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Money statement.

July 1, 1904, balance unexpended		$6,383.71
Proceeds sales of condemned property		11.09
Amount appropriated by river and harbor act approved March 3, 1905		30,000.00
		36,394.80
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$1,217.46	
For maintenance of improvement	2,602.44	
		3,819.90
July 1, 1905, balance unexpended		32,574.90
July 1, 1905, outstanding liabilities		1,760.43
July 1, 1905, balance available		30,814.47
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$25,000.00	
For maintenance of improvement	5,000.00	
		30,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

APPROPRIATIONS AND ALLOTMENTS.

For Tennessee River below Riverton, Ala.

September 19, 1890	$25,000.00
July 13, 1892	25,000.00
August 18, 1894	125,000.00
March 3, 1899	100,000.00
June 13, 1902	19,000.00
June 7, 1904 (emergency appropriation, act of June 13, 1902)	6,200.00
March 3, 1905	30,000.00
Total	330,200.00
October, 1903, paid by Ayer & Lord Tie Company for damage to United States dredge	26.93
August, 1904, proceeds of sales of condemned property	11.09
Total	330,238.02

COMMERCIAL STATISTICS.

Tennessee River above Chattanooga, Tenn.

Articles.	Year ending Dec. 31, 1904.		Articles.	Year ending Dec. 31, 1904.	
	Tons.	Estimated value.		Tons.	Estimated value.
Brick	344	$1,284	Marble	159,600	$1,596,000
Coal	10,360	25,900	Produce	882	54,153
Fertilizer	260	5,200	Railroad ties	4,471	8,941
Flour	226	13,542	Sand	90,960	60,640
General merchandise	4,094	805,398	Staves	25	450
Grain	19,615	466,583	Stone	43,500	205,500
Hay	6,879	123,800	Straw	2,487	19,896
Iron ore	118,400	210,550	Telegraph poles	5,000	35,000
Live stock	563	45,024	Wood	4,424	5,310
Logs	81,237	649,896			
Lumber	9,370	140,550	Total	562,677	4,473,617

Moved by steamboats and barges, 437,101 tons; by flatboats, 38,739 tons; in rafts (logs, poles, and lumber), 86,837 tons; number of passengers transported (1904), 5,507.

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Of the ten steamboats given in the last annual report as plying on the Tennessee River above Chattanooga, one, the *Flora Swann*, was not in this service during the year, and the number of barges was reduced from 86 to 70. One additional steamboat, the *City of Loudon*, was put on.

The total number of craft operating in this section of the river during the calendar year 1904 was 10 steamboats, of a total of 695 tons burden, net, and 70 barges, of a total capacity of 5,617 tons, as shown on list below:

List of boats and barges navigating the Tennessee River above Chattanooga, Tenn., during the year 1904.

Name.	Net tonnage.	Barges.		Between—	Miles on Tennessee River.
		Number.	Tonnage.		
City of Loudon	23	2	91	Chattanooga and Knoxville	183.5
N. B. Forrest	136	4	400	Chattanooga and Kingston	108.5
Gasconade	74				
Bill Tate	70	16	720	Kingston and Leadvale	84.5
Jane Austin	86				
City of Loudon	.....	1	80	Knoxville and Kingston	80.0
W. T. Gallaher	27	2	86	Pinhook and Loudon	60.0
				Pinhook and Harriman	36.5
Sam A. Connor	63	2	100	Chattanooga and mouth of Ocoee River	35.5
W. T. Gallaher	.....	.....	.....	Little Tennessee River and Harriman	34.5
Grady	150	8	2,400	Round Island mines and Rockwood Landing	20.0
Oliver King	42	10	400	Marble quarries on French Broad River and 10 miles below Knoxville.	14.5
Clinch	24	12	450	Paint Rock and Looneys Island	9.0
Oliver King	.....	2	80	Holston River and Knoxville	4.5
Grady	.....	1	700	Ironton ore dock and Rockwood Landing	4.0
	.....	2	28	Concord and Lenoir City	15.0
	.....	3	45	Lenoir City and Loudon	9.7
	.....	1	27	Seven Islands and Knoxville	4.5
	.....	1	15	Bussels Ferry and Lenoir City	2.5
	.....	1	15	Marble quarries on Tennessee River and Knoxville.	2.0
	.....	2	80	Knoxville and sand bar above	0.5
Total	695	70	5,617		

The steamers *Bill Tate*, *City of Loudon*, *Gasconade*, *Jane Austin*, *N. B. Forrest*, and *W. T. Gallaher* are also reported as plying on the Clinch River, and the *Bill Tate*, *Clinch*, *Jane Austin*, and *Oliver King* on the French Broad River. The *Oliver King* and two barges are again reported on the Holston River, and the *Sam A. Connor* and two barges are also given as navigating the Hiwassee River.

Comparative statement of commerce for the past ten years.

Year.	Tons.	Estimated value.	Year.	Tons.	Estimated value.
1895	265,256	$4,527,589.20	1900	380,697	$3,847,629.30
1896	623,915	2,788,022.20	1901	294,607	2,604,931.00
1897	256,331	2,698,802.85	1902	478,268	4,296,822.00
1898	218,378	2,425,066.60	1903	552,268	4,483,229.00
1899	269,552	2,839,087.55	1904	562,677	4,473,617.00

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Tennessee River between Chattanooga, Tenn., and Florence, Ala.

Articles.	Year ending December 31, 1904.		Articles.	Year ending December 31, 1904.	
	Tons.	Estimated value.		Tons.	Estimated value.
Brick	667	$3,335	Marble	50	$1,000
Coal	4,559	9,118	Peanuts	20	1,200
Cotton	4,718	943,600	Produce	1,068	69,914
Cotton seed	2,080	43,680	Railroad ties	8,113	18,930
Fertilizer	2,397	47,940	Sand	900	600
Flour	5,020	301,200	Spokes	14,500	51,250
General merchandise	21,586	4,313,360	Staves	8,187	159,756
Grain	11,559	226,137	Stone	511	2,555
Hay	766	13,778	Tan bark	384	5,376
Live stock	1,666	133,280	Tobacco	1	300
Logs	52,190	417,552	Wood	15,495	18,594
Lumber	15,465	231,975			
Iron, pig	959	25,252	Total	173,406	7,204,682
Machinery	550	165,000			

Number of passengers transported (1904), 14,420.

Of the traffic for 1904, 36,609 tons were moved by raft; 8,410 passengers and 39,971 tons of freight by railroad transfer boats between Hobbs Island and Guntersville, Ala., a distance of 22 miles; and of the remaining 96,826 tons, 13,911 were carried by the through boat plying between Chattanooga, Tenn., and Paducah, Ky.

Of the 14 steamboats given in the last annual report as plying on the Tennessee River between Chattanooga, Tenn., and Florence, Ala., 4 were not in this service during the year, but the number of barges was increased from 33 to 36. Five new boats were put on, as follows:

Name of steamboat.	Length.	Width.	Depth.	Net tonnage.	Height of pilot house.	Height of smokestack.	Number of barges.	Capacity of barges.
	Feet.	*Feet.*	*Feet.*		*Feet.*	*Feet.*		*Tons.*
Almanda	.....	.....	.....	73	20.0	28.0	2	300
Chastang	116	24	4.0	72	24.0	33.0	2	330
Chattanooga	175	33	5.0	310	36.0	48.0	.....	.....
J. R. Gunn No. 2	87	16	3.5	60	19.4	22.4	1	80
Mineola	55	12	5.3	9	.....	.....	2	60

The total number of craft operating in this section of the river during the calendar year 1904 was 15 steamboats, of a total of 1,510 tons burden, net, and 36 barges, of a total capacity of 6,570 tons, as shown on list below:

List of boats and barges navigating the Tennessee River between Chattanooga, Tenn., and Florence, Ala., during the year 1904.

Name.	Net tonnage.	Barges.		Between what points.	Miles.
		Number.	Tonnage.		
Chattanooga	310	.....	.....	Chattanooga and Paducah	464.0
City of Charleston	92	1	600	Decatur and Paducah	304.5
Decatur No. 1	48	16	3,600	Chattanooga and Florence	207.6
Joe Wheeler	196	4	400	Chattanooga and Decatur	159.5
Sam Davis	96				
Buck Lindsay	14	2	200	Bridgeport and Decatur	109.5
J. T. Reeder	54	1	80	Decatur and Hamburg	103.0
Almanda	73	2	300	Guntersville and Florence	101.3
Chastang	72	2	330	Sequatchie River and Hobbs Island	86.2
J. R. Gunn	43	1	40	Decatur and Lambs Ferry	24.0
J. R. Gunn No. 2	60	2	330		
Guntersville	204	3	580	Hobbs Island and Guntersville	22.0
Hattie McDaniels	67				
Huntsville	172				
Sam Davis	.....				
Mineola	9	2	60	Decatur and Browns Ferry	10.5
Total	1,510	36	6,570		

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Comparative statement of commerce for the past ten years.

Year.	Tons.	Estimated value.	Year.	Tons.	Estimated value.
1895	117,357	$2,099,520.88	1900	229,160	$5,499,779.40
1896	131,406	2,686,147.70	1901	129,160	4,584,322.00
1897	247,422	4,078,227.39	1902	137,861	5,567,464.00
1898	224,456	3,578,120.15	1903	297,851	7,439,914.00
1899	253,340	6,118,618.75	1904	173,406	7,204,682.00

The falling off in tonnage for 1904, as compared with the figures for 1903, may be accounted for by the fact that during the greater part of the last six months of 1904 the stage of water was too low to permit the regular steamers to ply on this section of the river.

Tennessee River between Florence, Ala., and Paducah, Ky.

Articles.	Year ending December 1, 1904.		Articles.	Year ending December 31, 1904.	
	Tons.	Estimated value.		Tons.	Estimated value.
Brick	505	$2,202	Lumber	44,206	$660,927
Coal	2,762	5,524	Marble (monuments)	20,877	2,099,156
Cotton	4,428	885,650	Peanuts	5,470	328,200
Cotton seed	2,051	43,079	Produce	817	87,758
Fertilizer	1,696	33,920	Railroad ties	598,987	1,607,478
Flour	6,621	397,266	Sand	9,000	6,000
General merchandise	34,862	6,972,400	Spokes	14,850	66,600
Grain	10,154	336,406	Staves	25,446	646,450
Hay	1,371	24,671	Stone (monuments)	27,000	2,970,000
Hoop poles	1,333	66,650	Tan bark	177	2,475
Iron ore	100	160	Tobacco	1,312	393,600
Live stock	4,504	281,475			
Logs	52,851	406,958	Total	871,380	18,325,005

Moved by steamboats and barges, 817,873 tons; by flatboats, 3,781 tons; in rafts, 49,726 tons; number of passengers transported (1904), 22,396.

Of the 40 steamboats given in the last annual report as plying on this section of the river 13 were not in this service during the year, and the number of barges was reduced from 270 to 206.

Two new and four additional boats were put on, as follows:

Name of steamboat.	Length.	Width.	Depth.	Net tonnage.	Height of pilot house.	Height of smokestack.	Number of barges.	Capacity of barges.
	Feet.	*Feet.*	*Feet.*		*Feet.*	*Feet.*		*Tons.*
Chattanooga	175	33.0	5.0	310	36	48	.....	.....
Kentucky	175	33.0	4.5	191	45	60	.....	.....
Jacob Heatherington	128	24.0	4.2	192	30	45	18	9,000
Jessie B	121	21.6	4.3	78	24	26	3	100
Wabash	120	32.0	4.0	141	30	40	2	900
City of Charleston	108	23.3	3.0	92	24	35	1	600

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The total number of craft operating in this section of the river during the calendar year 1904 was 33 steamboats, of a total of 4,445 tons burden, net, and 206 barges, of a total capacity of 90,203 tons, as shown in the following table:

List of boats and barges navigating the Tennessee River between Florence, Ala., and Paducah, Ky., during the year 1904.

Name.	Net tonnage.	Barges.		Between what points.	Miles.
		Number.	Tonnage.		
Chattanooga	810			Chattanooga and Paducah	464.0
City of Charleston	92	1	600	Decatur and Paducah	304.5
Clyde	335				
City of Memphis	322				
City of Savannah	293	8	900		
Kentucky	191				
Tennessee	248				
Shiloh	140				
Lyda	80	9	3,225		
Ten Broeck	149	7	3,000		
I. N. Hook	55	19	7,800	Florence and Paducah	256.5
Wilford	47				
Jacob Heatherington	192	18	9,000		
Castalia	90				
Inverness	121				
J. T. Duffy	146				
Margaret	201	80	40,000		
Pavonia	132				
Russell Lord	186				
John S. Summers	66	12	7,200		
Henrietta	153				
Victor	100	18	7,290	Waterloo and Paducah	227.0
Penguin	60				
Marie J	87	4	800	Hamburg and Paducah	201.5
Jessie B	78				
Lula E. Warren	78	8	1,200		
Woolfolk	105	6	2,600	Clifton and Paducah	157.5
Monie Bauer	87				
Mary F. Golden	37	3	1,200		
Wabash	141	2	900	Kellys Landing and Paducah	142.5
Lula E. Warren		4	800	Duck River and Paducah	110.0
J. T. Reeder	54	1	80	Decatur and Hamburg	103.0
Uncle Sam	57	2	1,400	Johnsonville and Paducah	96.0
Kuttawa	12	2	200	Pine Bluff and Paducah	53.6
No name		5	2,000	Clifton and Paducah	157.5
No name		2	8	Webbs Landing and Hunts Landing	4.0
Total	4,445	206	90,203		

Comparative statement of commerce for the past ten years.

Year.	Tons.	Estimated value.	Year.	Tons.	Estimated value.
1895	960,959	$15,966,852.84	1900	1,237,009	$6,105,127.40
1896	864,061	15,192,055.80	1901	658,102	6,322,450.00
1897	390,167	5,572,408.95	1902	1,056,270	15,370,604.00
1898	602,916	8,388,964.75	1903	848,758	8,720,215.00
1899	462,307	5,592,720.00	1904	871,380	18,325,006.00

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OPERATING AND CARE OF MUSCLE SHOALS CANAL, TENNESSEE RIVER.

Full details of the year's operations are given in the appended report of Mr. W. S. Winn, assistant engineer in charge of the work.

The hydraulic machinery and slide valves at Lock A, which had proved unsatisfactory, as stated in the last annual report, were replaced by hand-maneuvering appliances and balance valves similar

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to those used in the other ten locks of the canal. This hydraulic machinery is illustrated in the Annual Report for 1890, page 2126.

The upper gates at Locks 5, 6, 7, 8, and 9 are drop gates, all the other gates on the canal being mitering swing gates. For some time the drop gates have been troublesome to operate, owing to the deterioration of the wooden frame on which the gate rests when down and which holds the maneuvering shaft. At Lock 9 the wooden frame was replaced with a metal one about three years ago, and this gate has given no trouble since. It is proposed to substitute metal for the wooden frames at the other gates from time to time as they can be made at the canal shops. These drop gates are illustrated in the Annual Report for 1887, page 1742.

At Locks 7, 8, and 9 steel plates were let into the walls flush with their original faces at the ends of the drop gates to diminish leakage.

The matter of leakage through the canal bed and embankments requires considerable attention. Above Lock B a great number of small leaks developed, which were stopped by digging a trench 3 feet wide and 4 feet deep and filling it with puddled clay. At the lower division of the canal the worst leaks were between Locks 2 and 4, where the original embankment was composed largely of broken stone. These were partially closed by digging holes where the leaks appeared and filling them with stiff clay rammed in place. At Bluewater Creek the bed of the canal was dredged to a depth of 2 feet below grade, a layer of cinders scattered over the bottom, and about 18 inches of clay puddled over this while the canal was drained. This reduced the leakage about one-half.

The dredge *Alabama* was employed almost continuously. There were removed from the upper division 75,244 cubic yards of sediment, etc., and from the lower division 30,246 cubic yards, total, 105,490 cubic yards, at an average cost of about 3.1 cents per cubic yard.

About 6 more miles of the railroad track were reballasted with gravel, 49 barge loads, containing about 3,710 cubic yards of material, being used for the purpose.

Castings for use on the work, aggregating 28,931 pounds, were made, at a cost of 1.66 cents per pound.

About 77,591 feet B. M. of lumber were manufactured in the sawmill, at an average cost of $2.11 per 1,000 feet.

All of the buildings, 40 in number, were kept in repair, at an average monthly cost of about $2.46 for each building.

The right of way for a road connecting the canal land with the Huntsville and Florence road was acquired by the United States by purchase for the sum of $600. The road was cleared and repaired and 136 trees planted along it.

The dry dock at Lock 6 was extensively used in repairing floating plant, belonging not only to the canal, but also to other sections of the river. The dredges *Alabama* and *Kentucky*, steamboats *McPherson*, *Lookout*, *Colbert*, and *Kingman*, and derrick boats, barges, and dump scows were given considerable repairs.

On February 16, 1905, a report was submitted in response to Senate resolution of January 24, 1905, calling for information relating to ownership of lands adjacent to the canal and to the use of water power at the Muscle Shoals. This report is published in Senate Document No. 173, Fifty-eighth Congress, third session, and is reprinted as Appendix C C 5.

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In 1901 several suits against employees of the United States were begun by adjacent landowners on account of alleged damages due to the construction and maintenance of the canal by reason of land occupied or otherwise injured. Nothing had been done on these suits for several years, and it was supposed that they had been dropped. They were still on the docket, however, of the United States circuit court at Huntsville, Ala., and were finally brought to trial on May 27, 1905. On May 30, after hearing the evidence and arguments of counsel, the judge directed the jury to bring in a verdict for the defendants.

ABSTRACT OF ALLOTMENTS.

November 28, 1890	$40,000.00
July 1, 1891	31,792.04
July 1, 1892	45,232.90
July 1, 1893	60,975.19
July 1, 1894	63,772.63
July 1, 1895	64,793.11
July 1, 1896	62,707.46
July 1, 1897	67,979.55
July 1, 1898	62,868.17
July 1, 1899	59,239.20
July 1, 1900	63,000.00
July 20, 1900, to cover deficiency	355.95
November 2, 1900, to repair dam above Lock A	4,500.00
July 1, 1901	62,930.65
April 12, 1902, to repair storm damage	30,000.00
July 1, 1902	60,529.19
August 7, 1902, to rebuild hull of dredge	8,000.00
November 6, 1902, to purchase land	1,200.00
July 1, 1903	61,016.78
May 23, 1904, to purchase land	605.00
July 1, 1904	61,920.78
Total	913,418.60

Estimate of funds needed from appropriation for operating and care of canals and other works of navigation (indefinite), to be applied to current expenses in operating the Muscle Shoals Canal from July 1, 1905, to June 30, 1906.

Amount required for fiscal year ending June 30, 1906	$54,000.00
Balance remaining from allotment of preceding year	6,608.54
Additional allotment needed for fiscal year ending June 30, 1906	47,391.46

Summary of expenditures for operating and care of Muscle Shoals Canal for the fiscal year ending June 30, 1905.

Office and administration	$6,353.20
Operating and care of locks	6,407.52
Dredging, maintenance of embankment, etc	6,299.87
Buildings, grounds, etc., including machine shop, sawmill, and dry dock	3,427.87
Railway: Repair and operation	6,602.55
Towboat crews	1,416.00
Subsistence of employees	3,380.14
Supplies: Fuel, oil, rope, etc	8,663.89
Repair of dredge and plant, material, and contingencies	12,595.53
Total	55,146.57

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COMMERCIAL STATISTICS.

Statement of traffic through the Muscle Shoals Canal during the calendar year 1904.

Articles.	Tons.	Estimated value.	Articles.	Tons.	Estimated value.
Brick	10	$45	Live stock	3	$240
Coal	54	121	Logs	100	800
Cotton	157	31,400	Lumber	576	8,640
Cotton seed	791	16,611	Produce	12	915
Fertilizer	380	7,600	Railroad ties	1,220	4,880
Flour	81	1,860	Staves	4,498	78,715
General merchandise	2,118	372,051	Wood	340	1,020
Grain	168	4,054			
Implements, buggies, etc.	100	30,000	Total	10,560	559,002
Iron, pig	2	50			

The above is exclusive of supplies carried by Government steamers.

Number of passengers transported, 954; number of lockages made, 2,145.

There was no traffic through the canal during the month of October, owing to the unusually low stage of the river.

List of boats and barges using the Muscle Shoals Canal during the calendar year 1904.

Name of boat.	Net tonnage.	Barges.		Number of trips.
		Number.	Tonnage.	
City of Charleston	98	1	600	17
Chattanooga	310			13
J. R. Gunn No. 1	43	1	40	132
J. R. Gunn No. 2	60	2	330	25
J. T. Reeder	54	1	80	12
Sam A. Connor	63			1
Gasoline launch	10	4	200	6

Comparative statement of commerce for the past ten years.

Year.	Tons.	Estimated value.	Year.	Tons.	Estimated value.
1895	5,540	$158,680	1900	14,881	$297,894
1896	3,880	145,720	1901	11,925	592,634
1897	5,119	88,565	1902	7,712	577,505
1898	10,284	284,081	1903	10,571	712,150
1899	14,319	295,003	1904	10,560	559,002

REPORT OF MR. W. S. WINN, ASSISTANT ENGINEER.

UNITED STATES MUSCLE SHOALS CANAL,
Kingman, Ala., June 30, 1905.

MAJOR: I have the honor to submit the following report on the work under my local charge at Muscle Shoals Canal for the fiscal year ending June 30, 1905:

The same classification of work that has been used for the past eight years in the annual reports on this work will be adopted for this report, and is as follows:

Canal.—Operation and care of locks and similar structures, maintenance of embankment, and dredging and care of canal trunk.

Railway.—Maintenance of way, rolling stock (repairs, etc.), and operating expenses.

Telephone lines.—Operation and repairs.

Machine and blacksmith shops and foundry.—Operation and repairs.

Sawmill and carpenter shops.—Operation and repairs.

Buildings.—Improvements and repairs.

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Quarters and grounds.—Care of, etc.
Floating plant.—Operation and repairs.
Dry dock.—Operation and repairs.
Miscellaneous expenses.

CANAL.

Operation and care of locks and similar structures.—Of the eleven locks in the system, ten were originally equipped with hand-power maneuvering appliances, and the remaining one, Lock A, had hydraulic power for that purpose. The latter had given more trouble and cost more for repairs than the hand-power apparatus of the other ten locks combined. It was accordingly decided to replace the hydraulic plant at Lock A with the same appliances in use at the other locks. In submitting project for the change, the following reasons were given for making it:

"1. The hydraulic machinery at Lock A has cost more for repairs in the three years I have been here than the maneuvering apparatus for gates and valves at all the other locks combined. Repairs will be heavier in the future than they have been in the past. Water pipes will have to be dug up and replaced; the foundations under head race walls and under machinery pit, the bottom courses of which are wood, will have to be torn out and rebuilt; and some parts of the machinery will come in for repairs every month.

"2. In the winter the pipes freeze up so badly that the gates are swung during that time entirely by hand, and by the same kind of appliances as are used at the other locks. For the same reason the pipes leading to the valve cylinders are kept drained during the winter, except during high stages of the river, and the valves are operated by hand crabs, which are not of sufficient power to operate the valves during extreme high stages of the river. Then it is necessary to use hydraulic power, connecting up the pipes for every boat's passage during cold weather and draining the pipes after the boat has passed.

"3. To make good time locking a boat through, it is necessary to have two operatives who understand the hydraulic machinery. At the other locks one operative who understands the appliances is all that is necessary. Steamboat deck hands can give what assistance the operative needs.

"4. The repairs to the hydraulic machinery in the next two years will amount to as much as the estimated cost of making the change, and the latter once done will be much simpler, will not require any special skill in its manipulation, will require far less repairs, and will give uniformity in design of maneuvering apparatus throughout the entire system."

It was designed to make the change during the low-water season of the fall, when the work would not be interfered with by the passage of boats; but the valves, which were larger than the capacity of the foundry at this place and had to be contracted for elsewhere, did not arrive until more than a month after they were due, and by that time a boating stage had come. In the meantime so much freight had accumulated on the river and steamboat interests protested so vigorously against a suspension of navigation, that it was decided not to interfere in any way with the passage of boats. The valves, etc., were changed on one side of the lock at a time, leaving those on the other side free to make lockages with. If the work had been done as at first contemplated, during the time navigation was suspended on account of low water, the pool between Locks A and B would have been drained, the leakage through the cofferdams above Lock A taken care of with hand pumps, and the work prosecuted on all four valves simultaneously. As it was, boats passed nearly every day, cofferdams had to be built across all of the culvert openings, and a steam pumping outfit had to be installed to keep the water out of the valve chambers, while the workmen were more or less hampered by having to work in closer and darker quarters. For these reasons the work cost about $350 more than estimated. The change was effected early in January, and is very satisfactory.

Miter sills of the locks are surmounted by three parallel rows of 12-inch by 12-inch cushion sticks. Considerable leakage had developed between the cushion sticks and the lower sill at Lock A—so much, in fact, that it interfered with making lockages. The leaks were stopped by driving poplar wedges in the cracks.

The steamer *Decatur No. 1*, coming out of Lock B with a barge heavily loaded with logs, accidentally struck the corner of one of the upper gate recesses and displaced nine of the coping stones. Two of the stones had to be recut, and all were reset.

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When the river gets within 2.5 feet of low water, all the gates at Lock 1 are opened. During the time the gates are open, mud and leaves are deposited above the sills, and this deposit has to be scraped away before the gates can be closed again. This was done eight times during the year. Occasionally some of the interior locks have to be scraped in the same way, one scraping each having been necessary at Locks 2, 3, and 4 during the past year.

Cast-iron bedplates under the capstans with which the gates are maneuvered cracked at some of the locks, and were replaced with heavier ones having reenforcing ribs. Two each were put in at Locks 1 and 4, and one each at Locks 2 and 3. Heavier foundation stones were also put under those replaced at Lock 1.

All of the lock gates in the system are mitering swing gates, except the upper gates at Locks 5 to 9, which are combined wood and metal drop gates. The latter have been more troublesome to operate than the former, chiefly for the reason that the frame on which the gate rests when down, and which holds the maneuvering appliances, is not of sufficient strength or rigidity. The frames were built of wood, and, becoming softer as they grow older, no longer attach securely to their foundations or hold shafting and pinions in their proper positions. At Lock 7 a small piece of drift becoming wedged between rack and pinion was enough to lift the frame from its foundation attachments. A new metal frame was put in at Lock 9 three years ago, and that gate has given no trouble since. Similar frames will be put under the other drop gates as soon as they can be made in the shops without interfering with more urgent work. The frame for Lock 7 is about ready to put in.

Another trouble with the drop gates was the leakage that had developed between the ends of the gates and the lock walls. This joint is made by means of gas pipe, so mounted that with the lock empty the pressure due to head on gate forces the pipe into the angle between the gate and the wall. When the lock is full and the gate ready to drop, the pipe falls away from the wall, allowing the gate to go down freely and with no part of it in contact with the wall. A small piece of drift served to keep the pipe far enough from place to start a leak, and the leakage thus produced had eroded the walls until it became serious enough to interfere with lockages. At Locks 7, 8, and 9 steel plates were let into the walls, flush with their original faces, at the ends of the gates. This reduced the leakage to a minimum, and will prevent a recurrence of trouble from that source.

Other repairs to locks were of a minor nature, and are embraced in the following summary of repairs:

DETAILED STATEMENT OF REPAIRS TO LOCKS AND SIMILAR STRUCTURES.

Lock A.—Repaired hydraulic machinery every month until changes were made in valves and appliances; did away with hydraulic power and lift valves, and substituted valves and appliances similar to those in use at the other locks; stopped leakage between lower sill and cushion sticks by driving in poplar wedges; made new valve covers; cleaned drift and ice out of valve chambers.

Lock B.—Put in new capstan pinion and several sections of rack; recut two coping stones and reset nine.

Lock 1.—Scraped mud away from miter sills eight times; put in two new capstan bedplates and foundation stones under them.

Lock 2.—Scraped mud away from lower sill; tightened guy rods; repaired footbridges, and put in new capstan bedplate.

Lock 3.—Scraped mud away from lower sill; put in new capstan bedplate and two new miter posts; repaired footbridges and spar platforms.

Lock 4.—Attached one valve to shaft; scraped mud away from lower sill; put in two new capstan bedplates.

Lock 5.—No repairs.

Lock 6.—Scrubbed gates.

Lock 7.—Scrubbed gates; made new valve covers; repaired footbridges; put in new bevel gear; repaired old wood frame and built new metal frame; put in steel plates at ends of gate.

Lock 8.—Scrubbed gates; made valve covers; repaired footbridges; put in steel plates at ends of drop gate.

Lock 9.—Scrubbed gates; repaired footbridges and valve covers; put in steel plates at ends of drop gate.

Aqueduct.—Cleaned drift away from piers.

Bluewater dam.—Put in two new valves.

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Douglass Branch dam.—Put in three new valves.
Helltown Branch dam.—Put in one new valve.

Unit cost of operating and care of locks, etc.

Month (1904-5).	Number of lockages.	Cost per lock.	Vessels through canal.	
			Number.	Cost per vessel.
July	196	$45.61	31	$16.18
August	170	42.31	10	46.55
September	158	62.20	7	97.75
October		67.32		
November	79	55.28	4	152.03
December	282	157.38	29	59.69
January	294	69.60	45	17.01
February	211	42.08	36	12.84
March	227	89.83	33	13.27
April	281	47.47	42	12.43
May	185	48.56	29	18.42
June	60	46.77	30	17.15
Average per month	174	60.36	25	26.92

The number of lockages given includes those for craft belonging to the United States.

Maintenance of embankment and care of canal trunk.—Drift was removed from the lateral dam above Lock A for its whole length once, and several times more where greatest accumulations occurred. Part of the drift was used to make revetment to prevent dredged material from running back into the canal, and the rest was either burned or cut up and cast over the dam into the river. Logs were cleared out of the canal above Lock A after every rise. The dry wall just below Lock A was repaired.

Following the policy of reducing leakage through canal embankments year after year, some of the worst leaks were worked on. Above Lock B for about 600 feet of the canal's length the embankment was full of small leaks, the accumulation of which made a stream 6 inches deep and 3 feet wide. The leaks were so small that they could not be treated individually, so a trench 3 feet wide and 4 feet deep was dug in the canal slope of the embankment and filled with puddled clay. As a result the leakage was almost entirely stopped. The worst leaks remaining along the lower division were in the pools between Locks 2 and 3 and 3 and 4, where both the bottom of the canal and the embankment seem to be composed largely of broken stone, shot from the adjacent bluffs during the construction of the canal. Such a condition renders it very difficult to stop leaks. In the level between Locks 2 and 3 the leaks were dug out last fall and good stiff clay was rammed into the holes; yet some of the worst ones are as bad now as before this was done. To stop the leaks there I believe it will be necessary either to remove the mud from the crevices between the large stones and fill in with concrete or to dig a trench in the slope of the embankment down to bed rock and ram clay into it. It is believed that the former will be the cheaper plan, as bed rock is something like 15 feet below the top of the embankment in that locality. Nearly all the leaks show in the bottom of the canal.

Between Locks 3 and 4, at the head of the paved weir designed to discharge surplus water of Bluewater Creek during freshets, the stones in the canal bed show to be smaller than in the pool above, and the leaks are correspondingly smaller, giving the canal bed the appearance of a sieve. These small leaks run together in passing under the canal bed and embankment and discharge into the river in a number of streams, with a cross section of a foot or more each. The bed of the canal was dredged to a depth of 2 feet below grade, several carloads of cinders were scattered over the bottom of the canal while it was full, and then the pool was drained and about 18 inches of clay puddled over the bottom. This stopped about half the leakage. It is believed that to stop the leaks entirely it will be necessary to dig a trench along the slope of the embankment for about 400 feet of its length and ram clay into it.

Small leaks caused the top of the embankment to cave in at 30 different points during the year, but they were all discovered and repaired before serious damage was done.

Old stone ballast removed from the railroad track was used for riprap on the canal face of embankment in that reach and for about 600 feet between Locks 7

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and 8. The embankment was widened at Lock 3 to give wider roadbed for railroad track, and above Lock 2 to strengthen a place where a break had once occurred and which showed signs of weakness. Weeds were cut and ditches kept open.

Unit cost of maintenance of canal trunk and embankment.

Month (1904-5).	Cost per mile of canal.[a]	Vessels through canal.	
		Number.	Cost per vessel.
July	$34.54	31	$20.05
August	42.14	10	75.86
September	39.66	7	101.99
October	11.88		
November	8.56	4	38.54
December	15.89	29	9.86
January	16.51	45	6.60
February	13.53	36	6.76
March	13.56	33	7.39
April	9.07	42	3.88
May	8.56	29	2.21
June	17.85	30	10.71
Average per month	18.89	25	13.79

[a] Length of canal trunk, 18 miles.

Dredging.—The dredge *Alabama* worked some in every month except November, during which month it was laid up on account of water being too low to get coal for fuel, and because the point had been reached where the water on the rock reef above Lock A was too shallow to get the dredge over without damaging its bottom, and in June, when the work was so well caught up that the dredge was brought in for some much-needed repairs.

It began the season by removing 300 cubic yards at the mouth of a branch half a mile below Lock 6, after which it finished the level between Locks 4 and 5, giving 6.5 feet depth. It then dredged 1,300 feet of canal in front of Bluewater weir; then at the mouths of branches between Locks 2 and 3; then at the upper division, where it dredged all the way from Lock B to Miltons Bluff; and finally, on May 15, wound up by finishing a complete dredging from the head of the lower canal to Lock 1. The total quantity dredged was 105,490 cubic yards, of which 75,244 cubic yards were dredged from the upper and 30,246 from the lower canal.

Statement of dredging.

Month (1904-5).	Wages of operatives, cost of material expended, and repairs.	Cubic yards dredged (a).	Cost per cubic yard.
July	$447.22	10,501	$0.042
August	483.51	9,500	.050
September	411.17	17,599	.023
October	336.07	9,920	.034
November			
December	99.61	4,355	.023
January	380.32	10,010	.038
February	192.00	5,510	.034
March	379.38	16,100	.023
April	419.74	15,170	.027
May	192.13	6,825	.028
June			
Total	3,291.10	105,490	.031

[a] Mud, gravel, etc.

RAILWAY.

Maintenance of way.—The experiment, made two years before, of removing old stone and clay ballast and reballasting with creek gravel having proved a

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success in the matter of maintenance of track, advantage was taken of the presence at the canal of the lower river dredging fleet to use the dredge *Kentucky* and two barges in continuing that work. The gravel was dredged from Bluewater Creek, about half a mile above its mouth, placed on barges, and towed by the steamer *Kingman* to where it was to be used. The work was prosecuted from December 10, when the dredge became available, until it was ordered away, January 16. About 6 miles of track, including sidings, was reballasted, 49 barge loads of gravel, amounting to about 3,710 cubic yards, being used in the work. Before reballasting was begun the track gang worked two months leveling up and widening top of embankment so as to reduce the quantity of ballast to be used.

Repairs were commenced on Bluewater Bridge. New frames were put under three bents, and cross-ties were bought and guard rails sawed, about one-half of the old ones being too rotten to use again.

Rolling stock (repairs, etc.).—Every piece of rolling stock was in for repairs, mainly of a minor description, in the course of the year. The inspection car was painted and had new drawheads and bumpers put on.

Unit cost of operation and maintenance of railway.

Month (1904–5).	Cost per mile for maintenance of track.[a]	Miles run by engines.	Cost of operating, per engine-mile.
July	$37.94	1,608	$0.098
August	24.00	1,614	.096
September	20.97	1,492	.105
October	17.12	1,598	.092
November	10.87	1,176	.129
December	81.41	1,414	.106
January	65.04	1,494	.115
February	11.65	1,084	.145
March	19.65	1,368	.108
April	82.97	1,409	.108
May	13.82	1,492	.091
June	29.16	1,840	.109
Average per month	30.38	1,414	.107

[a] Length of track and sidings, 16 miles.

TELEPHONE LINES.

Operation and repairs.—While the lines have given better service than ever before, there were more breaks than usual. Most of these occurred between Locks 1 and B, where the line traverses land that is being cleared. Thirty new poles were put up, 22 of which were on Tick Island. Poles were set in the cribs in the crossing above Lock 1 and the line transferred to them, thus effecting a reduction of about half a mile in the length of the line and reducing the length of the spans in the river from 1,300 to 500 feet each. One of the cribs is not complete, and two others are only partially filled with stone. They were not filled because of their inaccessibility during low stages of the river, while no barges were available during the high stages.

Cost of operation and maintenance of telephone lines.

Month (1904–5).	Cost per mile.[a]	Month (1905).	Cost per mile.
July	$0.76	February	$1.26
August	.48	March	.88
September	1.69	April	.58
October	1.23	May	1.25
November	1.01	June	1.91
December	.78		
January	2.68	Average per month	1.21

[a] Length of lines, 38 miles.

MACHINE AND BLACKSMITH SHOPS AND FOUNDRY.

Operation and repairs.—Only the work incident to keeping the shops, tools, and machines clean and in repair was done, except that the cupola of the foundry was relined and new chimneys were made for the shops.

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More castings were made in the foundry than in any previous year. The majority of them were for making changes in valves and appliances at Lock A. Castings aggregating 28,931 pounds were made, at a cost for labor and material averaging 1.66 cents per pound.

SAWMILL AND CARPENTER SHOPS.

Operation and repairs.—Repairs to mill and appliances included hammering and filing saws, repairing woodworking tools and machines, and repairing mandrel, friction wheels, shafts, flumes, and pulleys. Six new cast-iron bevel gears were made and put in. These, however, broke after being in use a short time, so pattern was made and cast-steel gear secured, which have been running several months now and have not given any trouble. The building was jacked up and three new posts and sills put under where the old ones had rotted out. A new 60-inch inserted-tooth saw was bought and is giving good satisfaction.

Amount and cost of lumber sawed and planed.

Month (1904–5).	Sawed.		Planed.	
	Feet B. M.	Cost per M.	Feet B. M.	Cost per M.
July	653	$2.94	1,000	$2.50
August	9,136	1.62	11,094	1.14
September	5,064	1.34	480	3.54
October	10,368	2.18	7,358	1.20
November	9,473	2.40	5,948	1.68
December	3,392	2.39	3,020	1.50
January				
February	400	1.88	400	1.88
March	4,220	3.27		
April	6,349	2.01	2,874	1.67
May	11,950	1.98	7,366	1.48
June	16,586	2.24	16,586	1.26
Total and average	77,591	2.11	56,121	1.88

BUILDINGS.

Improvement and repair.—No new buildings were added during the year.

The houses, etc., painted were the lockmasters' houses and outbuildings at Locks 3 (finished), 6, and 9; roofs of barn, servants' quarters, and new storage building at Lock 6, and one room and two halls in assistant engineer's quarters.

Repairs to lockmasters' houses were made as follows: At Lock A, steps and floors, cistern house, roof, and gutters, and barn roof repaired; at Lock 1, floors repaired and new steps built; at Lock 3, new steps built and glass put in front door; at Lock 4, screens and lattice work put in; at Lock 5, steps and floors repaired; at Lock 6, woodwork repaired, plastering patched, and screens put in; at Lock 9, roof and fireplaces repaired, latticework and kitchen sink put in.

Assistant engineer's quarters had new quartered-oak rafter ceiling put in dining room, plastering patched, porch re-covered, servants' house re-covered, and outbuildings repaired. Roofs of barn, machine shop, and foundry were repaired. Lockman's house at Lock 4 was reshingled, and a stone foundation was put under the one at Lock 6. Sliding doors were made and hung on new storage building.

Unit cost of repairs and improvements of buildings.

Month (1904–5).	Cost per building.[a]	Month (1905).	Cost per building.
July	$2.66	February	$2.30
August	8.10	March	8.90
September	4.48	April	8.50
October	.48	May	1.19
November	.48	June	.24
December	.95		
January	1.28	Average per month	2.46

[a] Number of buildings, 40.

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QUARTERS AND GROUNDS.

Built fence at rear of lockmaster's house at Lock 9 from bluff to river; repaired fences around gardens at Locks A, 6, and 9; whitewashed fence around dry-dock yard; rebuilt fences around Lock 4 premises; repaired walks and drives in grounds at Lock 6. Title having been acquired to right of way for road from Lock 6 to Huntsville road through lands of M. C. Buxbaum, he was required to move his fences back off the lines. The right of way, 40 feet wide, was cleared of stones, bushes, etc., and 136 trees were planted along it. About 215 cubic yards of chert were quarried and put on the road. Quarters and grounds were kept clean.

FLOATING PLANT.

Dredge Alabama.—Guy wires that support the A-frame broke June 22, 1904, and repairs due to that cause continued until July 7. From August 8 to 12 minor repairs were made and the dredge dismantled in order to lighten it sufficiently to be sent to the upper division, where it was rerigged and put to work August 17. Ten days later the center spud broke below the bottom of the boat, and the channel-iron casing of the spud was so bent that it would not come up through the well. As there was no water accessible deep enough to drop the spud through the well, it had to be cut in two and brought to Lock 6 for repairs. On October 21 the dredge was dismantled and buckets, links, pins, bushings, and other fittings were brought to the shops to be overhauled. Twelve buckets had new shells and lip bands put on them, at a cost of about $15 each. The other buckets and all the links were repaired, having new pins and bushings put in wherever needed; old bushings were turned, oil holes drilled, rollers and boxings repaired and babbited. The machinery was put back on the dredge, and it resumed work December 13. On January 31 the center spud broke and five days were consumed in getting a new one, framing it, and putting it up. Only running repairs were made from that time to May 15, when foot casting of center spud broke, and the dredge was brought to Lock 6 for complete repairs. These included putting on new foot casting of spud, calking, scrubbing, painting, covering boiler, repairing pumps and other machinery, and putting new shells and lip bands on 12 buckets.

U. S. S. Kingman.—The *Kingman* had only running repairs, except in April, when a patch was put around the interior of the fire-box along the mud rim, and on May 18 it was put in the dock for extensive repairs. Roof and bulkheads were patched; new deck, deck beams, guard rim, towing knees, engine timbers, and stanchions put in; wheel rebuilt; rudders and posts repaired; calked and painted. The boat made 10 trips to Florence, 8 to Decatur, 1 to Riverton, 22 to upper division, and 26 miscellaneous shorter trips, and in addition was engaged thirty days towing gravel, in the canal, for reballasting railroad track.

Derrick Boat No. 3.—Had deck and rakes horsed and calked; cabin covered with tarred paper, pipes laid, pump and injector put in, and was painted throughout.

Barge No. 5.—Was placed on the aqueduct in the fall and calked preparatory to towing gravel. In the winter it was put in the dock for repairs to bottom, where a hole had been knocked in it while towing coal from Decatur.

U. S. S. Colbert.—Was put in the dock in March to have its hull searched and calked, deck patched, and rudders, wheel, guards, and roof repaired. Early in April, for the first time in a year, it was put in commission to carry a Board of Engineer officers from Chattanooga to Riverton. To get ready for the trip it was necessary to repair stairways, nosing, railings, and boiler deck. Seventeen outriggers and overlying plank-shear and decking were put on. Later it was decided to put it in such repair as would keep it from deteriorating, and it was painted, its deck calked, new breeching ordered, furnace repaired, machinery cleaned up and repaired, two short sections of smokestack and 13 fenders made, and both boiler deck guards covered with canvas. During the time it was in commission it made 1 trip to Chattanooga, 5 to Decatur, and 1 to the upper division.

Kingman's barge.—Had new nosing and stanchions put on one end.

U. S. S. McPherson.—In August the *McPherson* was put in the dock and gotten ready to go to Scott Point, with crew and outfit, to investigate lock and dam foundations at that place. A new ash well, 2 new rudders, and 16 bottom planks were put in; 27 broken floor timbers were spliced; stairways, railing, and wheel were repaired; casings around smokestacks and new work

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were painted; bottom, sides, and rakes were calked. Returning from that trip, in September, it was put out of commission until December, when it made two trips to the upper division and three to Decatur for coal. The boat remained idle then until it left the canal, May 16, for the river above Chattanooga. Further repairs were made to get it ready, as follows: Cabins, deck, and railings were repaired; new breeching and boiler casings made; furnace rebuilt; deck and rakes calked; capstan, doctor, pipes, and engines overhauled; roof and new work painted; and grate bars, furnace doors, and liners, aggregating 2,292 pounds of castings, made.

U. S. S. Lookout.—The boat was docked and given a thorough repairing, including the following items: Forty deck beams, 60 per cent of the decking, hog-chain braces, 1 rudder, kevels, fenders, and guard rim were put in new; cabins, roof, stairways, hatches, doors, windows, chocks, towing knees, 1 rudder, and wheel were repaired; hull was calked and boat painted from top to bottom. The engineer reported for duty December 6, and with his helpers was engaged in putting machinery back in place, repairing pumps and capstans, laying new pipes in hull, rebuilding furnace, etc. The boat left on January 16 for Kellys bar with the dredge *Kentucky* and barges, which were used in locating lock and dam site. On April 23 it again came to the canal for a three days' stay, undergoing some minor repairs—lining engines and putting in new cams and cam yokes. Patterns and castings were made for cams and yokes and whistle, and a 7 by 36 inch whistle was made.

U. S. dredge Kentucky.—It was thought that the hull of this dredge would require very little repair besides a new deck, but when the deck was torn away it disclosed a bad state of framework beneath. All the deck beams were rotten on top from gunwales to cabin. They were adzed off from ½ to 3 inches deep and sound timber was spiked on for the new deck to rest on. Three-fourths of the top timbers and side planks, one plank on bow rake and two on stern rake, stems, spud casings, cast-iron hatches, hand railings, stairways, and walk ways were put in new. Cabins, roof, and bottom were repaired. Two longitudinal bulkheads were put in hull from stern rake to forward end of boiler, and from there to bow they were continued in the form of Howe trusses. This construction was given to the forward end to provide openings through which to tighten bolts in spud casings, and to permit leaks around same to be easily discovered and stopped. The bulkheads were designed to give greater stiffness to parts of the boat upon which great strains come. The foot blocks of the A frame rest upon the bulkheads near the bow, and the A-frame guy wires attach to them near the stern. Deck, sides, rakes, and bottom were calked, and the boat was painted all over. Two capstans formerly on snagging barge No. 1 were installed. Repairs to woodwork necessitated the removal of a great part of the machinery. The engineer, with such force as he needed, overhauled this machinery and put it back.

Dump scows Nos. 1, 2, and 3.—Were docked and had bridges, stems, nosing, rakes, sloping decks, and cross bulkheads repaired. Flat decks, sides, rakes, and bottoms were searched and calked wherever needed.

Barge No. 9.—Had new sides, stems, rakes, and plankshear put on and bottom patched. Deck had been put on of green oak the year before, and it had shrunk until the seams were several times as large as they should be. All of the oakum had dropped out. The planks were wedged together and the large cracks filled with strips of lumber. Barge was calked and painted all over.

Barge No. 11.—Was docked, calked, and painted. Twelve new planks were put in bottom, and two additional rows of stanchions in the hull.

Quarter boat No. 3.—Was docked, calked, and painted throughout. Screen doors and windows were put in and roof repaired; hatches were covered and two rooms ceiled.

Skiff.—One skiff was made and delivered to watchman at lift rock, Colbert Shoals Canal.

Dry dock.—Twenty cubic yards of broken stone were placed in the dock to fill up holes and give dry footing to mechanics repairing boats. Dock had mud scraped from bottom after every filling, and the trash accumulated from repairs to boats was cleaned up. The following boats belonging to the United States were in the dock for repairs: Steamers *Kingman, Colbert, Lookout,* and *McPherson;* dredge *Kentucky;* dump scows *Nos. 1, 2,* and *3;* barges *Nos. 5, 9,* and *11,* and quarter boat *No. 3.*

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MISCELLANEOUS.

The items embraced under this head were about as usual, viz, hauling supplies from Florence, cutting and hauling wood for fuel, care of garden, hauling logs for miscellaneous purposes, making patterns, repairing tools and appliances, care of animals, handling coal, shoeing mules, checking and care of property, pay of laundress, pay of men on duty Sundays and holidays, etc. Built one gauge each for Kellys bar and Savannah, Tenn. Made fill about half a mile above Lock 6 for roadway for wagons and teams from bottom fields to top of canal embankment. Set gas-pipe monuments along boundary of road right of way acquired from M. C. Buxbaum.

Respectfully submitted.

W. S. WINN,
Assistant Engineer.

Maj. H. C. NEWCOMER,
Corps of Engineers.

C C 3.

IMPROVEMENT OF FRENCH BROAD AND LITTLE PIGEON RIVERS, TENNESSEE.

For details of these rivers, see page 458 of the Annual Report of the Chief of Engineers for this year.

The balance available at the beginning of the fiscal year was not sufficient to do any work, beyond making some minor repairs to the floating plant.

The river and harbor act of March 3, 1905, appropriated $2,000 for maintenance. It is proposed to apply the available balance and the additional appropriation recommended to maintenance of the navigable waterway by the removal of snags and other obstructions and the repair of existing works of regulation.

Money statement.

July 1, 1904, balance unexpended	$459.19
Proceeds sales of condemned property	1.88
Amount appropriated by river and harbor act approved March 3, 1905	2,000.00
	2,461.07
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	325.78
July 1, 1905, balance unexpended	2,135.29
July 1, 1905, outstanding liabilities	126.19
July 1, 1905, balance available	2,009.10
Amount (estimated) required for completion of existing project	63,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	2,000.00

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APPROPRIATIONS.

June 14, 1880	$10,000.00	June 13, 1902	$15,000.00
March 3, 1881	3,500.00	March 3, 1905	2,000.00
August 2, 1882	5,000.00		
July 5, 1884	3,500.00	Total	97,000.00
August 5, 1886	6,000.00	July, 1903, proceeds of sales	.08
August 11, 1888	10,000.00	August, 1904, proceeds of sales	1.88
September 19, 1890	10,000.00		
July 13, 1892	15,000.00	Total	97,001.96
August 18, 1894	7,000.00		
June 3, 1896	5,000.00		
March 3, 1899	5,000.00		

COMMERCIAL STATISTICS.

French Broad River, Tennessee.

Articles.	Year ending December 31, 1904.		Articles.	Year ending December 31, 1904.	
	Tons.	Estimated value.		Tons.	Estimated value.
Brick	37	$162	Lumber	5,280	$79,200
Farm produce	461	25,440	Marble	159,600	1,596,000
Fertilizer	125	2,500	Railroad ties	397	795
Flour	48	3,080	Sand	72,000	48,000
General merchandise	587	104,198	Straw	975	7,800
Grain	4,887	128,865	Wood	1,225	1,470
Hay	2,100	37,800			
Live stock	138	11,040	Total	258,847	2,129,246
Logs	10,987	87,896			

Moved by steamboats and barges, 247,635 tons; in flatboats, 725 tons; in rafts (logs and lumber), 10,487 tons. Number of passengers transported (1904), 2,811.

Of the five steamboats given in the last annual report as plying on the French Broad River, one, the *Flora Swann*, was not in this service during the year, and the number of barges was reduced from 47 to 39.

The total number of craft operating in the river during the calendar year 1904 was 4 steamboats, of a total of 222 tons burden net, and 39 barges, of a total capacity of 1,597 tons, as shown in the following table:

List of boats and barges navigating the French Broad River during the year 1904.

Name.	Net tonnage.	Barges.		Between—	Miles on French Broad River.
		Number.	Tonnage.		
Bill Tate	70	16	720	Leadvale and Kingston	69.5
Jane Austin	86				
Oliver King	42	10	400	Marble quarries, 10 miles above Knoxville, to 10 miles below Knoxville.	5.5
Clinch	24	12	450	Paint Rock (French Broad River) and Looneys Island (Tennessee River).	3.8
		1	27	Seven Island shoals and Knoxville	14.0
Total	222	39	1,597		

The above steamboats are also reported as plying on the Tennessee River above Chattanooga; the *Bill Tate* and *Jane Austin* again on the Clinch River, and the *Oliver King* on the Holston River.

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Comparative statement of commerce for the past ten years.

Year.	Tons.	Estimated value.	Year.	Tons.	Estimated value.
1895	42,898	$1,333,962.00	1900	160,827	$1,225,677.50
1896	249,204	1,469,835.00	1901	108,340	922,052.00
1897	70,756	617,255.80	1902	157,819	1,810,772.00
1898	124,960	928,361.90	1903	102,076	1,089,453.00
1899	102,263	779,705.10	1904	258,847	2,129,246.00

C C 4.

IMPROVEMENT OF CLINCH, HIWASSEE, AND HOLSTON RIVERS, TENNESSEE.

(A) CLINCH RIVER.

For details of this river, see page —— of the Annual Report of the Chief of Engineers for this year.

The only work done during the year consisted in minor repairs to floating plant.

The river and harbor act of March 3, 1905, appropriated $6,000 for the Clinch and Hiwassee rivers, for continuing improvement and for maintenance. Of this sum $1,500 were allotted to the Clinch River for maintenance. It is proposed to apply the available balance and the additional appropriation recommended to maintenance of the navigable waterway by removing snags and other channel obstructions and repairing existing works of regulation.

Money statement.

July 1, 1904, balance unexpended	$898.23
Proceeds sales of condemned property (allotment)	.54
Amount appropriated by river and harbor act approved March 3, 1905 (allotment)	1,500.00
	2,398.77
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	370.16
July 1, 1905, balance unexpended	2,028.61
July 1, 1905, outstanding liabilities	28.84
July 1, 1905, balance available	1,999.77
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	2,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

June 14, 1880	$10,000.00	June 13, 1902 (allotment)	$3,000.00
March 3, 1881	3,000.00	March 3, 1905 (allotment)	1,500.00
August 2, 1882	3,000.00		
July 5, 1884	5,000.00	Total	54,500.00
August 5, 1886	5,000.00	July, 1903, proceeds of sales	.56
August 11, 1888	5,000.00	August, 1904, proceeds of sales	.54
September 19, 1890	4,000.00		
July 13, 1892	4,000.00		
August 18, 1894	2,500.00		
March 3, 1899	8,500.00	Total	54,501.10

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COMMERCIAL STATISTICS.

Clinch River, Tennessee.

Articles.	Year ending Dec. 31, 1905.		Articles.	Year ending Dec. 31, 1905.	
	Tons.	Estimated value.		Tons.	Estimated value.
Brick	88	$2,115	Lumber	6,220	$98,450
Coal	360	720	Railroad ties	676	1,962
Farm produce	783	48,398	Sand	2,985	1,990
Fertilizer	155	3,100	Staves	25	125
Flour	201	12,042	Straw	1,362	10,896
General merchandise	3,391	831,048	Telegraph poles	5,000	35,000
Grain	14,578	334,082	Wood	8,075	3,690
Hay	3,917	70,500			
Live stock	257	20,544	Total	100,701	1,980,686
Logs	57,628	461,024			

Moved by steamboats and barges, 37,153 tons; in rafts (logs and lumber), 63,548 tons. Number of passengers transported (1904), 5,222.

Of the 8 steamboats reported in the last annual report as plying on the Clinch River, 2, of a total of 81 tons burden net, were not in this service during the year, and the number of barges was reduced from 51 to 23.

The total number of craft operating in this river during the year ending December 31, 1904, was 6 steamboats, of a total of 416 tons burden net, and 23 barges, of a total capacity of 1,236 tons, as shown on list below.

List of boats and barges operating in the Clinch River during the year 1904.

Name.	Net tonnage.	Barges.		Between what points.	Miles on Clinch River.
		Number.	Tonnage.		
W. T. Gallaher	27	2	86	Lees Ford and Harriman	45.5
				Pinhook and Harriman	4.5
				Little Tennessee River and Harriman.	4.5
City of Loudon	23	1	30	Kingston and Knoxville	.8
Bill Tate	70	16	720	Kingston and Leadvale	.8
Jane Austin	16				
N. B. Forrest	136	4	400	Kingston and Chattanooga	.8
Gasconade	74				
Total	416	23	1,236		

These steamboats are also reported as plying on the Tennessee River above Chattanooga. The *Bill Tate* and *Jane Austin* are further reported as navigating the French Broad River.

Comparative statement of commerce for the past ten years.

Year.	Tons.	Estimated value.	Year.	Tons.	Estimated value.
1895	68,900	$439,409.30	1900	132,511	$1,462,294.75
1896	39,456	357,783.00	1901	164,586	1,633,103.58
1897	102,629	908,238.46	1902	129,925	2,272,848.00
1898	160,345	865,759.50	1903	161,716	2,847,372.00
1899	185,691	2,391,624.65	1904	100,701	1,980,686.00

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(B) HIWASSEE RIVER.

For details of this river see page 460 of the Annual Report of the Chief of Engineers for this year.

No work was done during the year except minor repairs to floating plant.

The river and harbor act of March 3, 1905, appropriated $6,000 for the Clinch and Hiwassee rivers, for continuing improvement and for maintenance. Of this sum, $4,500 was allotted to the Hiwassee River.

It is proposed to apply the available balance and the additional appropriation recommended to the maintenance of the navigable waterway by removing snags and other channel obstructions and repairing existing works of regulation, and to continuing improvement in the vicinity of Agency shoals and Rogers shoals, about 7 and 10 miles, respectively, above the mouth of the river. These obstructions are described in the Annual Report for 1901, pages 2472–2473.

Money statement.

July 1, 1904, balance unexpended		$112.12
Proceeds sales of condemned property		8.23
Amount appropriated by river and harbor act approved March 3, 1905, (allotment)		4,500.00
		4,620.35
June 30, 1905, amount expended during fiscal year, for maintenance of improvement		110.00
July 1, 1905, balance unexpended		4,510.35
July 1, 1905, outstanding liabilities		23.04
July 1, 1905, balance available		4,487.31
Amount (estimated) required for completion of existing project		56,625.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$3,000.00	
For maintenance of improvement	2,000.00	
		5,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

APPROPRIATIONS.

August 14, 1876	$10,000.00	June 13, 1902 (allotment)	$10,000.00
June 13, 1878	10,000.00	March 3, 1905 (allotment)	4,500.00
March 3, 1879	3,000.00		
June 14, 1880	3,000.00	Total	51,000.00
March 3, 1881	1,500.00	August, 1904, proceeds of sales of condemned property	8.23
August 2, 1882	1,500.00		
July 5, 1884	2,500.00	Total	51,008.23
August 15, 1886	2,500.00		
August 11, 1888	1,000.00		
September 19, 1890	1,500.00		

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COMMERCIAL STATISTICS.

Hiwassee River, Tennessee.

Articles.	Year ending December 31, 1904.		Articles.	Year ending December 31, 1904.	
	Tons.	Estimated value.		Tons.	Estimated value.
Brick	105	$240	Logs	1,380	$11,040
Fertilizer	100	2,000	Lumber	40	600
Flour	25	1,375	Produce	75	5,500
General merchandise	100	20,000	Straw	100	800
Grain	286	10,500	Wood	437	525
Hay	55	1,000			
Live stock	300	24,000	Total	3,008	77,580

Moved by steamboat and barges, 1,623 tons; in rafts, 1,380 tons. Number of passengers transported (1904), 260.

One steamboat, the *Sam A. Connor*, of 63 tons burden, net, with two barges of a total capacity of 100 tons, navigated the river for the first three months of the year. It was then sold, and no steamer plied on the river during the remainder of the year.

Comparative statement of commerce for the past ten years.

Year.	Tons.	Estimated value.	Year.	Tons.	Estimated value.
1895	8,876	$145,431.60	1900[a]		
1896[a]			1901[a]		
1897[a]			1902	16,041	$340,207.00
1898[a]			1903	13,852	412,412.00
1899[a]			1904	3,008	77,580.00

[a] Commercial statistics not obtained.

(C) HOLSTON RIVER.

For details of this river, see page 461 of the Annual Report of the Chief of Engineers for this year.

No work was done during the year aside from the care of floating plant. The balance of the allotment of $5,000 made July 1, 1902, from the appropriation of $18,000 in the act of June 13, 1902, for the Clinch, Hiwassee, and Holston rivers, is retained for the purpose of clearing the channel of overhanging trees and other obstructions, as the interests of commerce may demand from time to time.

Money statement.

July 1, 1904, balance unexpended	$1,776.10
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	300.00
July 1, 1905, balance unexpended	1,476.10

APPROPRIATIONS.

July 1, 1902 (allotment)	$5,000

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COMMERCIAL STATISTICS. YEAR ENDING DECEMBER 31, 1904.

Holston River, Tennessee.

Articles.	Tons.	Estimated value.
Logs	11,149	$89,192
Lumber	1,100	16,500
Total	12,249	105,692

Moved in rafts, 12,149 tons; by steamboat and barges, 100 tons.

The only steamboat traffic on the river during 1904 consisted of one trip 5.5 miles up the river, made by the steamer *Oliver King*, of 42 tons burden net, with two barges of 80 tons capacity, which brought out a cargo of lumber.

C C 5.

TENNESSEE RIVER, AT MUSCLE SHOALS CANAL.

[Printed in Senate Document No. 173, Fifty-eighth Congress, third session.]

ENGINEER OFFICE, UNITED STATES ARMY,
Chattanooga, Tenn., February 16, 1905.

GENERAL: I have the honor to submit the following report in compliance with your indorsement of January 26, 1905, on Senate resolution of January 24, 1905, calling for certain information with reference to the lands and water power at the Muscle Shoals Canal. A small lithograph map [a] showing the general situation at the canal, and a tracing on much larger scale showing the lines of the present and old canals, with adjacent lands, are transmitted herewith, marked "A" and "B," respectively.

The first paragraph of this resolution reads as follows:

Resolved, That the Secretary of War inform the Senate of the condition of the Muscle Shoals Canal, on the Tennessee River, with reference to the right of way for said canal, and as to any tracts of land along the line that are necessary to be acquired by the Government for the security or convenience of operating or maintaining the same.

The United States undoubtedly owns the right of way for the upper section of the canal, having purchased the necessary land for this purpose, as shown on map B.[a] The ownership of the lands occupied by the lower section of the canal is not so clear, but it is held that practically all private titles to these lands have been extinguished either by the United States or by the State of Alabama.

The lands along this section that have been actually purchased by the United States are shown on map B, and these portions, of course, clearly belong to the United States. The remaining portions of the right of way are thought to be the property of the United States, either by adverse possession for a sufficient term of years or as belonging to the right of way of the old canal built by the State under the authority of Federal law and controlled by the State for many years prior to the time when the United States assumed charge of the work and rebuilt it.

[a] Not reprinted; printed in S. Doc. No. 173, 58th Cong., 3d sess.

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By act of May 23, 1828, the United States granted the State of Alabama 400,000 acres of public land to aid it in improving the Tennessee River at Muscle shoals and Colbert shoals in accordance with plans to be approved by the President of the United States. Under this law, and in accordance with an act of the legislature, approved January 15, 1830, the State undertook the work through a "board of Tennessee canal commissioners," who were, among other things, empowered to acquire the right of way through private lands, and to pay all damages that might result to such lands by the construction of the canal, which was planned to give passage around the Big Muscle shoals.

Certain of the public lands referred to above were reserved for a time for canal purposes, and then sold in conformity with an act of the State legislature approved January 15, 1831. The deeds for these lands embodied the provisions of the act which required—

that the purchasers thereof shall permit the canal commissioners to take, free of any charge, any part thereof for the use of the said canal, or to take and use, free of any charge, any timber, stone, gravel, or earth, or convert any stream of water thereon to the use of said canal, free of any charge or expense to said canal whatever.

The lands abutting on the lower section of the canal, on which these canal privileges were reserved by deed, are indicated by yellow margin on map B.[a]

The old canal around Big Muscle shoals was begun in 1831 and opened in 1836. It is to be presumed that the canal commissioners acquired the necessary right of way through private lands and paid all damages to such lands that may have resulted from the canal construction. The canal soon fell into disuse, but the State continued to exercise control over it until the United States took possession and began rebuilding it in 1875. It was opened to navigation in its present form in 1890.

In rebuilding the canal there were some departures from the old line. Several suits for damages on account of land occupied or injured by the present work have been instituted against the United States. Some of these were discontinued and others settled by the purchase of the land in question. There are no such suits, however, known to this office pending against the United States at the present time.

If, as is believed, the right of way for the canal is now rightfully in the possession of the United States, there are no tracts of land along the line that are now deemed "necessary to be acquired by the Government for the security or the convenience of operating or maintaining the same."

The question of acquiring the private lands, amounting to about 341 acres, that lie between the river and the lower section of the canal, has been under consideration for some time. Mr. W. S. Winn, the assistant engineer in charge of the canal, recommends their purchase on the following grounds:

First. To afford dumping ground for the material that must periodically be dredged from the canal trunk.

Second. To afford borrow pits from which to get earth for stopping leaks, repairing breaks, strengthening embankments, etc.

[a] Not reprinted; printed in S. Doc. 173, 58th Cong., 3d sess.

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Third. To settle questions of disputed ownership.

Fourth. To avoid all further claims for damages arising from private ownership of these outside lands.

These undoubtedly represent advantages of some value, but after considerable deliberation I am not convinced that they are of sufficient importance or urgency to warrant the purchase of all of these outside lands at the present time. It is probable that these needs, should they require additional ground, can be satisfied by the purchase of limited portions of these tracts. No present action is recommended.

The second paragraph of the Senate resolution reads as follows:

Second. And that he will advise the Senate of his opinion as to the best method of acquiring such lands—whether by process of condemnation or by purchase—and whether a commission is necessary for that purpose.

If at any time it should be considered advisable to acquire additional land for the canal, it would be better to do so by purchase in case the price demanded is reasonable and a good title can be thus secured. Otherwise the land should be acquired by process of condemnation. In neither case would it appear to be necessary to have a commission authorized for the purpose, as the War Department can take the necessary steps under authority granted by the act of April 24, 1888.

The third paragraph of the Senate resolution reads as follows:

Third. And that he will inform the Senate (first) whether the water power at Lock 6 on said canal is being usefully employed for supplying power for the machinery at said lock, that belongs to the United States; and (second) whether it will be useful to the public service to increase such machinery for the purpose of being employed in the construction or repair of boats, dredges, and the preparation of materials or machinery for use in Government work for the improvements on the Tennessee River or its tributaries.

The first question is answered in the affirmative, and the second in the negative. The water power at Lock 6 is used to run the machines in the carpenter shop, sawmill, and planing mill. By this means much of the lumber required for repairs to the Government buildings and boats is manufactured from logs at a cost considerably below the market value of such material. The tools in the machine shop are run by steam power. This shop is not conveniently located with reference to the water power, except for electric transmission, and this would require the installation of an electric power generating plant. The expense of reorganizing the shop on this basis would probably be out of all proportion to the saving in operation that might be effected for the small amount of power that is used. Moreover, at certain stages of the river the available supply of water from the canal is practically exhausted by the present plant. In short, the present facilities for making repairs appear to be ample for the present needs of the Government works of improvement on the Tennessee River and its tributaries.

The fourth paragraph of the Senate resolution reads as follows:

Fourth. And that he inform the Senate whether the War Department has granted, or sanctioned, or approved any grants, licenses, or privileges for the use of the water power of the Tennessee River, on any part of the Muscle shoals, to any persons or corporations, and that he state the terms, conditions, and extent of such grants, privileges, or licenses, and the authority under which the same have been made.

This office has no information that the War Department has ever taken any such action as that described in this paragraph, unless its

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action should be so regarded in one instance, when, under date of August 17, 1904, I was authorized by the Department to inform the owners of the land on both sides of Turkey Island Chute (nearly opposite Lock 6) that the War Department would interpose no objection to their constructing a dam across this chute, provided it is so built as not to obstruct or injure navigation in any way.

The only real grant of the above character known to me is that made by Congress to the Muscle Shoals Power Company by act of March 3, 1899, which is as follows:

AN ACT granting to the Muscle Shoals Power Company right to erect and construct canal and power stations at Muscle Shoals, Alabama.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the consent of Congress is hereby given to the Muscle Shoals Power Company, a corporation created and organized under a charter granted by the legislature of the State of Alabama, its successors or assigns, to erect, construct, operate, and maintain inlet and outlet races or canals and a power station or stations at a point or points at or near the Muscle shoals in Tennessee River, and to make such other improvements as may be necessary within said limits for the development of water power and transmission of the same: *Provided*, That the constructions hereby authorized do not in any way interfere with the Muscle Shoals Canal or with navigation of said river: *Provided further*, That until the plans and location of the works herein authorized, so far as they affect the interests of navigation, have been approved by the Secretary of War, the improvements shall not be commenced or built, and the Secretary of War is authorized and directed to fix reasonable charges for use of said power.

SEC. 2. That unless the work herein authorized be commenced within one year and completed within three years from the date hereof the privileges hereby granted shall cease and be determined.

SEC. 3. That the right to alter, amend, or repeal this act is hereby expressly reserved.

The times for beginning and completing the work under this law have been successively extended by acts of June 6, 1900; March 1, 1901, and February 18, 1903. According to the last act the company must begin work before February 18, 1905, but it has not yet submitted plans to the Secretary of War for approval, as required by the law.

The fifth and last paragraph of the Senate resolution reads as follows:

Fifth. And that he will inform the Senate of his opinion whether it is advisable to create a commission, and as to how it should be constituted, to examine into and report upon all or any of the matters referred to in these resolutions, and especially as to the disposition that should be made of the water power furnished by the shoals of the Tennessee River, above mentioned; and what legislation, if any, Congress should provide for the proper adjustment and regulation of the rights of the United States and of the State of Alabama, and also of the riparian proprietors and the owners of islands in the Tennessee River at those localities.

In view of what precedes, I have no suggestion to offer of any work to be undertaken by a commission. I am not aware that the United States has any right or interest in the water power that can be developed at the Muscle shoals, aside from its control over the waterway for purposes of navigation and its ownership of the canal property.

Very respectfully, your obedient servant,

H. C. NEWCOMER,
Major, Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

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APPENDIX D D.

IMPROVEMENT OF OHIO RIVER BY OPEN-CHANNEL WORK AND CONSTRUCTION OF LOCK AND DAM NO. 37—OPERATING SNAG BOATS ON OHIO RIVER.

REPORT OF LIEUT. COL. E. H. RUFFNER, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1905, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Ohio River (general improvement).
2. Construction of Lock and Dam No. 37, Ohio River.
3. Operating snag boats on Ohio River.

UNITED STATES ENGINEER OFFICE,
Cincinnati, Ohio, July 17, 1905.

GENERAL: I have the honor to transmit herewith the annual reports of the works under my charge for the fiscal year ending June 30, 1905. (District No. 1.)

The summary and estimate; the reports for construction and repairs to dikes and low dams; for repairs to ice piers; for existing harbor lines and encroachments; for bridge and other permits, issued by the Secretary of War; for repairs to quarter boats, etc.; for construction of Lock and Dam No. 37; for surveys and examinations, and for special dredging at Grassy flats, have been prepared by Chief Assistant Engineer R. R. Jones.

The report for general dredging has been prepared by Assistant Engineers E. J. Carpenter and J. Nelson Caldwell.

The report for operating snag boats on the Ohio River has been prepared by W. H. Christian, master U. S. snag boat *E. A. Woodruff*.

Very respectfully, your obedient servant,

E. H. RUFFNER,
Lieut. Col., Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

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D D 1.

IMPROVEMENT OF OHIO RIVER.

GENERAL IMPROVEMENT.

Operations on this improvement were in progress during the last fiscal year under the general project that has been in force for many years, as follows:

DIKES AND LOW DAMS IN THE OHIO RIVER.

CONSTRUCTION.

Dike at the head of Grand Chain, Ohio River (about 943 miles below Pittsburg).—Under project dated February 8, approved February 18, 1905, the construction of a riprap dike in the Ohio River at the head of Grand Chain was contemplated, having a length of about 1,600 feet, carried to a height of 6 feet above low water, and containing about 10,000 cubic yards of stone. This was to secure the improvement recommended by Col. G. J. Lydecker. (See Report of the Chief of Engineers for 1904, Appendix D D, pp. 2478–2482.)

Bids for this work were opened May 31, the only bidder being Oscar F. Barrett. As the amount available for this work and for the extension and repair of the Mound City dikes was inadequate for both, the work at Grand Chain was given up for the present.

REPAIRS.

The repairs of dikes and dams, rendered necessary by reason of damage from ice and floods during previous seasons, and, in some cases, by the natural decay of perishable material used in original construction, were carried on during the low-water season under project dated July 9, approved July 28, 1902, at the following localities on the Ohio River: Browns Island, Marietta Island, Buffington Island, Raccoon Island, Eightmile bar, and Fourmile bar.

Browns Island dam (60.5 miles below Pittsburg).—This dam was originally constructed in 1837–38 as a riprap dam to close the back channel of Browns Island, and was repaired in 1881–1883 and 1883–84 by the construction of a timber crib superstructure. It is about 2,700 feet long, built up to about a 6-foot stage, and extends from the Ohio shore to head of the island.

Minor repairs were made to this dam during the season of 1900, which consisted principally in bracing the center bulkhead and back filling with stone.

The dam was again in such bad condition in 1904 that it was decided to refill with loose stone only, without attempting to replace the timber which had been carried away. Proposals for furnishing about 1,500 cubic yards of loose stone, delivered on barges at site of dam, were opened September 26, the prices bid ranging from $2 to $3.90 per cubic yard. The lowest bidder failed to enter into contract, and as the season for such work was growing late, negotiations were opened for the purchase of stone in open market. On October 21 a

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proposal for furnishing stone in place in the dam at $2.10 per cubic yard was accepted. The delivery of stone was begun October 26 and completed November 26, the total quantity of stone placed in the dam being 2,272.11 cubic yards.

Prior to the acceptance of the proposal (October 21), contemplating the placing of stone in the dam by the contractor, preparations were made to do this work by hired labor; lumber for run plank, tools, etc., for handling stone were purchased, and a few laborers in charge of an inspector were engaged for a short time in the preliminary work.

A statement showing the material used and the cost of repairs to the dam at head of Browns Island during the season of 1904 is given below.

Tools, lumber, etc	$57.23
Travel and incidental expenses	56.95
Labor	56.40
Stone, 2,272.11 cubic yards, at $2.10	4,771.43
Inspection	250.00
Total cost, season 1904	5,192.01

No record of the cost of this dam as originally built in 1837–38 is obtainable, but the cost of the work since the year 1881 is herewith given:

Repairs by constructing timber crib, 1881–1883	$33,172.67
Repairs by constructing timber crib, 1883–84	1,189.67
Repairs by bracing center bulkhead, etc., 1900	1,080.38
Repairs by loose-stone filling, 1904	5,192.01
Total cost since 1881	40,634.73

Total cost per linear foot of dam, $15.05.

The repairs conducted during season of 1904 can be considered to have prolonged for a few years only the life of the present dam, which was threatened with total destruction for nearly one-half its length. It is believed that, within a few years at most, a dam should be constructed of durable material, crossing the back channel on a line nearly perpendicular to the channel, with a length of from 730 to 800 feet (depending on final location), instead of attempting to rebuild on the site of present dam with its great length of 2,700 feet. In the event that such a dam be decided on, it might be constructed either wholly of concrete or of loose stone capped (after settlement had taken place) with concrete.

The ever-increasing cost of good oak timber and its comparatively short life when exposed alternately to the effects of water and the atmosphere, is a strong argument against new construction in anything but such durable material as stone or concrete.

In deciding upon the repairs just completed it was believed that a large part of the stone could, at small cost, be moved down to the site of a new dam and be therein used.

The work of repairs was carried on under the supervision of Mr. E. A. D. Parker, junior engineer.

Marietta Island dam (168.9 miles below Pittsburg).—The original construction of a riprap dam to close the back channel of Marietta Island was projected in 1868, but conflicting interests delayed the final location. Under the appropriation of March 3, 1871, a contract was

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let for quarrying stone to be used in this dam, and at the close of the fiscal year ending June 30, 1871, the work of closing the back channel was progressing rapidly. The dam was reported as completed during the season of 1871, the total quantity of stone used in its construction being 10,949 cubic yards. Owing to injuries received from ice, repairs were soon required, and 12,857 cubic yards of stone together with 6,118 cords of brush and 316 piles were used in such repairs. Definite statements of the cost of the dam above described are not easily accessible, but on the basis of cost of other dams in the same general region and about the same time the entire cost up to the close of 1873 must have been about as follows:

	Stone.	Brush.	Piles.
	Cu. yds.	*Cords.*	*No.*
Original construction	10,949		
Repairs and auxiliary dam	12,857	6,118	316

Statement of cost.

23,806 cubic yards stone, at $2	$47,612
6,118 cords brush, at $2.50	15,295
316 piles, at $2	632
Total	63,539

By the year 1889 the dam required repairs, and it was decided to place upon it a timber superstructure. Under a contract dated February 9, 1889, this work was completed during that year at a cost of $22,147.52. The dam as thus reconstructed had a length of about 916 feet and, as then believed, a height of about 7½ feet compared with the gauge at Marietta, Ohio.

During the seasons of 1900 and 1901 repairs were placed on the dam to the amount of $1,210.02, by cutting down a portion of the dam and reframing some of the timbers for use at other places in the dam.

During the severe winter of 1903–4 all the central portion of the dam, which had been cut down and repaved, was carried out by heavy running ice, leaving a break which extended approximately to low water, so that to all intent the dam was useless. In order that the benefit of a dam at the head of the island might not be entirely lost, and in response to requests from the Pilots' Association and the Pittsburg Coal Exchange that the dam be repaired, temporary repairs with loose stone were decided upon.

On October 22 proposals were opened for furnishing about 1,000 cubic yards of loose stone on barges at site of dam, the lowest bid being $1 per cubic yard. Delivery of stone was begun October 31 and the work completed November 26, 1,205.94 cubic yards of stone being placed in the dam.

The following statement shows the material used and the cost of repairs to this dam during the season of 1904:

Stone, 1,205.94 cubic yards, at $1	$1,205.94
Supplies, tools, etc	37.01
Travel and incidental expenses	30.73
Labor	311.10
Inspection	125.00
Total cost, season 1904	1,709.78

Cost per cubic yard to handle and place stone, $0.346.

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In addition to the stone purchased, about 250 cubic yards were gathered up from below the dam and replaced therein. The work was carried on by hired labor under the supervision of Mr. Clinton B. Harris, junior engineer.

A summary of the cost of the work on dam at head of Marietta Island from its inception may be stated as follows:

1871–1873 (partly estimated)	$63,539.00
1889, under contract of February 9, 1889	22,147.52
1900–1901 by hired labor	1,210.02
1904 by hired labor; stone contracted for	1,709.78
Total cost	88,606.32

The question of original cost and repairs has been detailed at some length, more particularly as it would seem to furnish a strong argument in favor of the replacement of present dam by a structure formed of concrete, carried down to such depth as would insure against undermining or settlement. If it be urged that the construction of movable dams under the system now approved would obviate the necessity of low fixed dams—shutting off back channels—(as in the case of Marietta Island) it may be said that during times of low water in the winter navigation must depend largely on a system of low dams and dikes whose construction is such that little or no injury can be inflicted on them by running ice. It is believed, therefore, that many of the more important dams shutting off back channels, must be maintained even after a system of movable dams has been entirely completed.

No estimate for a permanent dam of concrete has as yet been prepared, and before an estimate with any degree of closeness is attempted it would be wise to have borings made to determine the precise character of the material underlying the probable site of dam.

Buffington Island dam (215.5 miles below Pittsburg).—This is a riprap dam originally built in 1837–1844 to close the back channel of Buffington Island. Including the protection along the Ohio shore it has a total length of about 2,260 feet, a height of about 6 feet above low water, and a width on base of about 50 feet.

This dam was inspected in 1892, at which time there were two breaks, one of 65 feet and another of 125 feet, measured along the crest of the dam, but otherwise the dam was then in fair condition. Petitions were received from the Pittsburg Coal Exchange and the Pittsburg Pilots' Association, under date of September 3 and 10, respectively, asking that repairs and alterations be made to certain old dams, and that one new dam be constructed. In response to this request, repairs to the dam at head of Buffington Island were decided on, and proposals for furnishing about 500 cubic yards of stone on barge at site of dam were opened September 26, the lowest bid being $1.85 per cubic yard. Delivery of stone was begun October 10 and was completed October 27, 738.45 cubic yards of stone being placed in the dam under this arrangement. In addition to the stone purchased, about 100 cubic yards were recovered from the shallow water about the dam and replaced.

The following statement shows the stone purchased and placed in the dam, together with the cost of the work done during season of 1904.

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Stone, 738.45 cubic yards, at $1.85	$1,366.13
Travel and incidental expenses	49.34
Labor	181.44
Inspection	75.00
Total cost, season 1904	1,671.91

Cost to handle and place stone in dam, $0.3647.

The stone was unloaded and placed in the dam by a small force of laborers, under local direction of Mr. Charles W. Leftwich, foreman.

The cost of the original dam built in 1837–1844 can not be stated, but the cost of the work since the year 1867 is herewith given:

Repairs made during season of 1867–1869	$11,800.00
Repairs made during season of 1904	1,671.91
Total cost since 1867–1869	13,471.91

Cost per linear foot of dam (since 1869), $5.96.

It is believed that this dam at the head of Buffington Island, constructed of loose stone, with a total expenditure of but $13,471.91 in thirty-five years (amounting to only $5.96 per linear foot of dam), makes an excellent showing in comparison with those dams built partly of timber at far greater original cost.

The beneficial effects of the repairs completed during the past season have already been observed by steamboat men, and it is thought that the usefulness of this dam will be extended for many years by reason of such repairs.

Raccoon Island dam (274.4 miles below Pittsburg).—This is a riprap dam to close the back channel of Raccoon Island, and was apparently built subsequent to 1867, although the precise date can not readily be determined. It is about 1,000 feet in length and was originally built up to about a 6-foot stage.

Upon the completion of repairs to the ice pier at Gallipolis, Ohio, 5.3 miles above Raccoon Island, it was decided to move the tools, wheelbarrows, etc., down to the site of Raccoon Island dam and make such repairs as could be conducted in the few weeks remaining of the season suitable for such work. Stone was procured in open market from the contractor who had furnished stone for the ice-pier repairs at Gallipolis, at the same price, $1.65 per cubic yard.

Delivery of stone was begun November 4, and the operations were suspended for the season on November 23, 782.7 cubic yards of stone being placed in the dam.

Prior to the repairs made during past season the dam was in very bad condition, the lower end being much washed down, and at a point 625 feet from the Ohio shore a gully had been scoured down far below the original base of dam. The repairs consisted in filling the deeply scoured portion and raising the general level of dam, beginning at a point about 250 feet from the Ohio shore.

The following statement shows the cost of the work during season of 1904:

Stone, 782.7 cubic yards, at $1.65	$1,291.46
Travel and incidental expense	31.20
Labor	241.40
Inspection	125.00
Total cost, season 1904	1,689.06

Cost to handle and place stone in dam, $0.508.

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The stone was delivered on barges at site of dam and placed in position by a small force of hired laborers employed directly by the United States. The general level of crest of dam after repairs was about 3 feet above low water. It is believed that to be really effective the crest of dam should be raised to a level of about 6 feet above low water, which is probably near the original height at middle and outer end. It is respectfully recommended that the repairs as suggested above be completed when funds for such work are available in sufficient amount.

The work of repairs was in local charge of Mr. Frank A. Bone, junior engineer.

Eightmile dike (455.5 miles below Pittsburg).—The work of repairing the timber crib dike at Eightmile bar, about 13 miles above Cincinnati, Ohio, was a continuation of that begun during the previous season. These repairs consisted in replacing defective or missing cross-ties and portions of the top course of timbers, building a strong ramp at lower extremity of dike, refilling and paving with stone where required.

Following is a statement showing the material placed in dike, together with the cost of repairs, during season of 1904:

Oak timber (16,822 feet, B. M.)	$422.61
Stone (35 cubic yards)	33.25
Drift bolts (1,716 pounds)	47.19
Hire of barges	84.00
Supplies	50.71
Travel and incidental expenses	15.16
Labor	345.22
Inspection	90.00
Total cost, season 1904	1,088.14

Material was purchased under advertisement, barges hired by the same method, and the work was carried on directly by the United States, a small force of carpenters and laborers being employed from August 27 to September 30.

A summary of the cost of Eightmile dike follows:

Original construction, 1886	$37,506.11
Repairs, season of 1903	895.08
Repairs, season of 1904	1,088.14
Total cost	39,489.33

Upper, Middle, and Lower Fourmile dikes (458.6 to 460.2 miles below Pittsburg).—The arrangements for procuring material, hire of barges, etc., referred to in the foregoing report on Eightmile dike, contemplated also the work of repairs on Upper, Middle, and Lower Fourmile dikes, the repairs required being of the same nature.

Upon completion of repairs to the dike at Eightmile the force employed on this work, together with the tools, etc., were moved to the next dike below (Upper Fourmile), and repairs to this dike were begun October 1 and completed November 7.

The statement given below shows the material placed in the dike, together with the cost of repairs during season of 1904.

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Upper Fourmile dike.

Oak timber (39,862 feet, B. M.)	$932.77
Stone (101 cubic yards)	95.95
Drift bolts (3,936 pounds)	108.24
Hire of barges	456.00
Towing and incidental expenses	48.17
Labor	747.12
Inspection	98.67
Total cost, season 1904	2,486.92

The repairs to Middle Fourmile dike were begun on November 8 and completed December 2.

Statement showing material placed in dike and cost of repairs follows:

Middle Fourmile dike.

Oak timber (36,202 feet B. M.)	$847.13
Stone (131 cubic yards)	124.45
Drift bolts (4,873 pounds)	134.01
Hire of barges	276.00
Supplies	1.75
Labor	615.21
Inspection	61.33
Total cost, season 1904	2,059.88

The repairs to Lower Fourmile dike were commenced December 3 and completed December 29.

Following is a statement showing material placed in dike and the cost of repairs during season of 1904:

Lower Fourmile dike.

Oak timber (19,790 feet B. M.)	$463.08
Stone (109 cubic yards)	103.55
Drift bolts (2,739 pounds)	75.32
Hire of barges	114.00
Hauling and incidental expenses	21.00
Labor	610.10
Inspection	77.33
Total cost, season 1904	1,464.38

No repairs had been made to these dikes since their original construction up to the past season; the total cost of these dikes may therefore be stated as follows:

	Built.	Original cost.	Repairs, 1904.	Total cost.
Upper dike	1880	$34,022.13	$2,486.92	$36,509.05
Middle dike	1881	39,458.61	2,059.88	41,518.49
Lower dike	1887	50,719.61	1,464.38	52,183.99
Total cost		124,200.35	6,011.18	130,211.53

A summary of the material placed in the four timber-crib dikes at Eightmile, Upper, Middle, and Lower Fourmile, and the total cost of repairs to same during the season of 1904, is given below:

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Oak timber (6,300 feet B. M., at $28)	$176.40
Oak timber (106,376 feet B. M., at $23.40)	2,489.19
Stone (376 cubic yards, at 95 cents)	357.20
Drift bolts (13,264 pounds, at 2¾ cents)	364.76
Hire of flatboats	930.00
Supplies	56.64
Towing, hauling, etc	80.15
Labor	2,317.65
Inspection	327.33
Total cost, season 1904	7,099.32

Comparative statement of the estimated and actual cost of repairs to 4 timber-crib dikes.

	Estimated cost.	Actual cost.	Below estimate.
Eightmile dike	$1,612.39	$1,088.14	$524.25
Upper Fourmile dike	2,946.23	2,486.92	459.31
Middle Fourmile dike	2,776.69	2,059.88	716.81
Lower Fourmile dike	1,664.69	1,464.38	200.31
Total	[a] 9,000.00	7,099.32	1,900.68

[a] See Report Chief of Engineers, 1904, Appendix D D, pages 2421–2422.

The work of repairs to Eightmile, Upper, Middle, and Lower Fourmile dikes was in local charge of Mr. Charles Anschutz, inspector.

It is believed that the repairs to these dikes will prolong their usefulness for many years.

Mound City, Ill., dikes (about 958 miles below Pittsburg).—This work is in the nature of extending and repairing two dikes in the Ohio River near Mound City, Ill., as follows:

(1) An extension of 1,640 feet to the river end of a short dike (230 feet) now existing on the Kentucky shore, and repairs to the old portion of said dike.

(2) An extension of 670 feet to the river end of a dike now extending from the Kentucky shore and situated about 2,800 feet below the first-named dike, and repairs to the old portion (about 1,770 feet) of said dike.

These dikes are intended to establish and maintain a reliable channel along the Mount City frontage of the Ohio River, as suggested by Col. G. J. Lydecker (see Report Chief of Engineers, 1904, Appendix D D, pp. 2459–2465 and 2456–2459).

The project for this improvement was submitted February 8 and approved February 18, 1905, contingent upon the termination of an old contract for dike construction at this locality. This contract having expired by limitation and without action, the work was advertised in connection with the work of building a dike at the head of Grand Chain, it being deemed more advantageous to the United States to invite bids for the work at both of these points at the same time. Bids were opened May 31, and award of contract to Oscar F. Barrett recommended. Contract was entered into June 14, 1905, and approved June 23, 1905.

Preliminary arrangements for conducting the work are now under way and actual operations under the contract will begin as soon as conditions of river and weather are favorable.

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The two dikes near Mound City will, it is estimated, contain about 13,700 cubic yards of stone, and will cost approximately $37,212.50.

Ice piers.—At Middleport, Ohio, 251 miles below Pittsburg. The ice pier at Middleport consists of three sections, the two outer sections having been built in 1888–89 and the inner section in 1896. All are of timber-crib construction, faced on the upper side with heavy timbers and filled with loose stone. The foundation was made by building up from the bed of the river with loose stone to the level of low water or a little above.

Under project submitted July 8, approved July 21, 1902, a plan for repair was proposed which involved the cutting away of the outer timbers and constructing a facing of concrete anchored to the interior of the crib. The estimated cost of such rebuilding for three cribs was $10,055. The severe ice which prevailed during the winter of 1903–4 damaged the pier to such an extent that repairs of some kind were urgently required. The ends of the timbers in the two outer sections of pier had rotted so that the iron drift bolts no longer had holding in the woodwork. Portions of the tops of both cribs had been carried away, and a bulge had taken place about halfway up the middle crib.

A careful examination of the foundations of the cribs, all three of which had settled materially on the lower outside corners, led to the conclusion that it would be unwise to place concrete walls on the old base.

It only remained, therefore, to tear away the old cribs entirely, dredge out the bottom to a lower level, and then erect new structures, or else to effect temporary repairs on the present cribs with timber, iron, and stone in a manner corresponding to their original construction. The latter course was finally adopted.

Material was purchased, in general, under advertisement, and the work of repairs was begun October 19 with a small force of carpenters and laborers employed directly by the United States.

The repairs consisted in replacing entirely about 11 feet of the top of the two outer cribs. Defective timbers lower down in the structures were repaired by splicing bad ends of timbers and blocking same. A few timbers in the inner crib were repaired in like manner. Several missing ring bolts with their anchors were also replaced, and diagonal tie bars were provided for the two outer cribs and bolted to the oak timbers. During the progress of replacing the timbers at the top a light but strong wooden bridge was built to connect the two outer cribs, and over this bridge the stone filling was moved from whichever crib was in process of taking down. As fast as new timbers were secured in position, the stone was moved back and packed in place once more. A number of willows had grown up around the inner crib. These were cut away, and a large accumulation of drift about all three cribs was removed to permit a free flow of water at ordinary stages of the river.

A statement showing the material placed in the pier and the cost of repairs is given below:

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Oak timber (33,640 feet B. M.)	$1,017.61
Drift bolts (3,875 pounds)	95.90
Ironwork (3,815.5 pounds)	134.79
Stone (75 cubic yards)	101.25
Hire of flatboat	30.00
Supplies, tools, etc	143.97
Travel and incidental expenses	71.34
Labor	784.08
Inspection	183.33
Total	2,562.27

The work of repairs was completed December 9. Mr. Harry H. Peters, inspector, was in local charge of operations, while Mr. Clinton B. Harris, junior engineer, had general supervision over the reconstruction.

The ice pier at Middleport has been in constant use as a harbor of refuge since its construction, and it is thought that the repairs made during the past season will add materially to the life of the pier.

Gallipolis, Ohio (267.5 miles below Pittsburg).—The ice pier at Gallipolis, Ohio, consists of two sections of timber-crib construction, faced with heavy timbers on upstream side and filled with stone. These cribs were built in 1889. The river bed at site of pier, so far as can be determined, consists of rather soft material, underlaid by sand and fine gravel.

The project submitted July 8, approved July 21, 1902, contemplated cutting away the outer timbers and building walls of concrete in place thereof, at an estimated cost of $6,822; also the addition of a third section of concrete construction, at an estimated cost of $7,350.

Urgent requests for repairs to existing cribs came to this office, and another examination was made, which developed the fact that, as in the case of the pier at Middleport, the present foundations were inadequate for the support of concrete walls. The question of location of an additional section, to be built of concrete, also developed opposing opinions from river men interested in its construction.

In view of all the circumstances, it was deemed advisable to proceed with temporary repairs on the two existing timber cribs, which had been greatly damaged by the heavy ice during the winter of 1903–4, leaving the matter of concrete construction and the building of an additional section for further consideration.

Timber, stone, and iron were purchased under advertisement and the work begun September 15 with a small force of carpenters and laborers hired by the day directly by the United States.

The repairs consisted in taking down both cribs for about 10 feet below the top and replacing some timbers on the outer sides of both cribs below that level. The stone filling was moved across from one crib to another during the progress of the work, on a bridge similar to that described in connection with the Middleport pier. In addition to drift bolting the timbers in the usual manner, corner irons were secured to the downstream corners of both cribs.

Following is a statement of the material placed in pier and the cost of repairs during season of 1904:

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Oak timber (29,480 feet B. M.)	$913.88
Drift bolts (2,967 pounds)	73.37
Stone (223.3 cubic yards)	368.45
Iron straps (1,050 pounds)	21.00
Tools, supplies, etc	120.23
Hire of flatboats and towing	308.00
Travel and incidental expenses	31.85
Labor	482.00
Inspection	187.50
Preliminary examination	198.58
Total	2,704.86

The repairs were completed November 3, the pier being then left in condition, it is hoped, to continue its very useful service for some years to come.

The work was in local charge of Mr. Frank A. Bone, junior engineer.

The unusually severe damage sustained by river interests from the ice during the winter of 1904–5 made apparent the necessity for enlarging the harbor of refuge at Gallipolis and, as stated above, the question of the location of an additional section of ice pier having developed opposing ideas among river men interested in its construction, the matter was again thoroughly canvassed through correspondence with all parties interested in river commerce in the locality, with the result that the majority of expressions favored the location of the new section on the inner or shore side of the present structures.

Plans and specifications for the construction of an additional section of ice pier to be built of concrete were accordingly prepared and together, with the project for the work, were forwarded to the Department April 22, and were approved May 2. Bids for the work were opened June 13, and the lowest bidders, Frank J. DuVall and Fred C. DuVall, were awarded the contract, which was entered into June 30.

The contract for the construction of one section of ice pier requires the contractor to furnish all necessary materials except cement, which will be furnished by the United States, bids for the same having been opened June 30.

Actual construction on the new section of this ice pier at Gallipolis, Ohio, will be commenced as soon as the stage of river will permit.

Maysville, Ky. (407.4 miles below Pittsburg).—Owing to lack of funds no work was done on the ice pier at Maysville, Ky., during the past season. This pier consists of three sections, built of concrete, resting on timber-crib foundations filled with stone. The three sections were carried up to a height of about 13 feet above low water during the season of 1903. In order to make them serve fully the purpose intended they require to be built up to heights varying from 20.5 to 26.5 feet greater than at present.

The river and harbor act of March 3, 1905, contained the following provisions:

Improving Ohio River: General improvement. * * * *Provided further*, That the unexpended balance of funds available for the construction of an ice pier at or near the mouth of Big Hocking River may, in the discretion of the Secretary of War, be expended toward the completion of an ice pier at Maysville, Kentucky.

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A project, together with plans and specifications, which contemplated the completion of the ice pier at Maysville, Ky., was forwarded to the Department April 22, and approved May 2. Bids for the work were opened June 13, the lowest bidder being W. L. Glazier, with whom contract was entered into June 26. This contract contemplates the furnishing of all necessary materials by the contractor with the exception of the iron work, a portion of the timber forms for use in concrete construction, and the cement, all of which are to be furnished by the United States. The iron work and a part of the necessary timber forms are already on hand, having been purchased by the United States for use in connection with the construction of an ice pier near the mouth of Big Hocking River, which work was afterwards abandoned (see Report of the Chief of Engineers for 1904, Appendix D D, p. 2407). The cement for this work will be furnished by the United States, bids for the same having been opened June 30.

The contractors for this work are now engaged in making preliminary preparations and actual construction will begin at an early date.

Harbor lines.—The established harbor lines over which supervision is exercised by this office are those at Steubenville, Wheeling, Ironton, and Cincinnati.

The usual work was continued during the year in the investigation of encroachments, and of permits requested or authorized.

Permits.—Applications for special permits require a considerable expenditure of time and labor for the necessary examinations in the field and the subsequent supervision in order to secure compliance with harbor-line restrictions and prevent interference with the interest of navigation. The total number of permits granted during the year and pertaining to this district was 24, of which 3 were for gas-pipe lines, 3 for oil-pipe lines, 5 for overhead cables, 1 for submarine cable, 3 for inclined planes, 3 for intake pipes and cribs, 1 for posts as ice breakers, 1 for ponton bridge, 1 for dumpage, 2 for dredging, and 1 for viaduct.

Bridges.—The railroad bridge across the Ohio River just below Mingo Junction, Ohio, built by the Cross Creek Railroad Company upon plans approved February 7, 1902, was completed and opened for traffic in June, 1904. Report on inspection submitted to the Chief of Engineers November 17, 1904.

The railroad bridge across the Ohio River near Ceredo, W. Va., built by the West Virginia and Ironton Railroad Company upon plans approved December 24, 1889, was completed and opened for traffic several years ago, but final report on the bridge was deferred until portions of the cofferdams around channel piers should be removed; these obstructions have been removed to a sufficient depth below low water to render them unobjectionable to coal-boat navigation. Report on inspection submitted to the Chief of Engineers December 1, 1904.

Repairs to quarter boats and steamer Edna.—It was found that the hulls of the two quarter boats and the steamer *Edna* were in a condition necessitating repairs.

Proposals were therefore invited for the repairs in question, and a contract entered into with the Parkersburg Dock Company under date of June 14, 1905.

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The boats were taken to Parkersburg June 6 and repairs begun soon thereafter. At the close of the fiscal year repairs were completed on quarter boat *No. 2* and progressing satisfactorily on quarter boat *No. 1*.

Surveys and examinations.—There was no work in the field on surveys, but office work on the reduction of large scale maps of Ohio River surveys was in progress during the year.

Proposals were invited June 5 for photolithographing and printing a series of these charts or reduced maps of Ohio River surveys, and on June 12 the bids were opened, and under authority of the Chief of Engineers, dated June 23, the award was made to the lowest bidder, the United States Lithograph Company, and the necessary contract papers were prepared for execution.

Examinations with a view to the improvement of the present channels or the opening of new channels were made at the following places: Mustapha Island, bar at Evansville, Ind., Slim Island, and Grand Chain.

Dredging at Grassy Flats bar.—In response to complaints received from steamboat owners and pilots of interruption to navigation by the condition of the bar at Grassy flats, Ohio River, 580 miles below Pittsburg, the dredge *Louisville No. 1*, together with her tender, steamer *Col. G. L. Gillespie*, were borrowed temporarily from the Louisville district, and the work of dredging at this locality was begun August 10 and was completed September 28, 15,860 cubic yards of material having been removed from the channel, at the following cost:

Fuel	$362.05
Supplies	23.94
Travel and incidental expenses	22.85
Subsistence of dredge and tender crews	268.29
Labor	1,468.38
Inspection (including a survey of the locality)	250.00
Total	2,395.51

Cost per cubic yard of material dredged, $0.151.

The dredging secured a channel with an average depth of 4½ feet below low water for a length of about 1,600 feet, with an average width of 85 feet. The channel thus dredged was used exclusively by boats navigating this portion of the river during the low-water season of last fall, and no further complaints have been made of this usually troublesome bar.

The survey made at Grassy flats has been platted by Mr. E. A. D. Parker, junior engineer, who had local charge of the dredging operations.

Dredging.—The dredging plant remained in winter quarters in the Little Kanawha River at Parkersburg until May 18, when it was removed to Marietta, Ohio, for the completion of necessary repairs.

The project for the season's work provided for the removal of a number of creek bars that had built out into the river at various points, making the channel difficult and dangerous for packets and towboats, the most troublesome places being between Wheeling, W. Va., and Marietta, Ohio.

On June 11, the repairs having been completed and the stage of river being favorable for work, the plant left Marietta to begin the season's operations.

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As most of the bars were so short that there was not room for both dredges to work on them without interfering with each other, a small extra towboat tender was hired and the dredges were operated separately, at points not too far apart to prevent proper supervision.

About the middle of August the river became too low to permit effective work on the creek bars, the stage of water preventing access to the dumping grounds; and as a still lower stage of considerable duration was to be expected at that season, the plant was moved back to Marietta and utilized to dredge out the harbor at mouth of the Muskingum River, for which a special allotment had been made. It was expected that after expenditure of this allotment the plant would resume operations on the Ohio River; but as the low water continued until winter, and no Ohio River work except the bar just opposite the mouth of the Muskingum was accessible, operations in the Muskingum were continued in preference to laying up the plant, particularly as this improvement rendered available for Ohio River craft the best ice harbor above Middleport.

The work of the dredges during the season was as follows:

Coon Run bar, West Virginia (114.9 miles below Pittsburg).—This bar, consisting of gravel, bowlders, and loose rock carried into the river by the creek, making a sharp, high point, which extended more than 500 feet from the shore line, caused trouble to packets and much danger to tows at ordinary boating stages.

The high part of the bar was removed to 5 feet below low water as far as the low-water shore line above the bar, straightening the channel and widening it 275 feet, the length dredged being 600 feet.

The excavated material was dumped on right of the channel, close to the Ohio shore above the bar, and was also utilized to close the chute behind Clines bar, just opposite, whenever the river was high enough to permit getting scows to that place.

Excavation made, June 14 to July 7:

Gravel, bowlders, and loose rock	cubic yards	24,630.0
Rocks removed (4)	tons	6.3

Blair Run bar, Ohio (opposite Fish Creek Island, 113 miles below Pittsburg).—This bar, composed of bowlders, rock, and gravel carried out by the run, projected into the river from the Ohio shore, causing a turn in the channel so sharp that at stages when navigation at other points was comparatively easy it was difficult and dangerous at this place. The point of the bar was dredged off 5 feet below low water, widening the channel 190 feet, the length of area dredged being 830 feet.

The excavated material was dumped on left of the channel, close to and just above the foot of Fish Creek Island, where it serves to direct the river current into the channel and to prevent scour along the island.

Excavation made, June 22 to July 8:

Gravel, bowlders, and loose rock	cubic yards	16,950.0
Logs and snags removed (2)	tons	2.0
Rocks removed (2)	do	5.6

Short Creek bar, West Virginia (81 miles below Pittsburg).—Just after the work at Blair Run and Coon Run was completed a rise of the river obliged the dredges to suspend operations. During this time the plant was moved up to Short Creek, 9 miles above Wheeling, W. Va., with the hope of removing a part of this bar before the river fell

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sufficiently to necessitate its return to below Wheeling. The rise was of short duration, permitting only three days' work by one dredge; but the point of the bar was removed 5 feet below low water, widening the channel 105 feet for a length of 290 feet and affording considerable relief to tows.

Excavation made, July 15 to 18:

Gravel, bowlders, and loose rock	cubic yards	2,089.0
Rocks removed (1)	tons	2.2

Barnes Run bar, Ohio (133.6 miles below Pittsburg).—This bar, consisting of gravel and bowlders, projected into the channel from the Ohio shore, obliging boats to make a sharp turn above and below it. The channel was straightened; the total length of area dredged 5 feet below low water being 630 feet, the width added to the channel by removal of the bar being 120 feet.

The material excavated was dumped along the West Virginia shore above the old riprap dike, which extends to the bar at head of Williamsons Island.

Excavation made, July 20 to August 1:

Gravel and bowlders	cubic yards	12,560.0

Mill Creek bar, Ohio (opposite Mill Creek Island, 141 miles below Pittsburg).—The bar at this place is a deposit of gravel and bowlders, with many large rocks, carried out into the river by the large creek and forming an obstruction which has caused much damage to tows and packets. The channel close above the bar was also obstructed by a number of very large rocks, which had probably been brought down by the ice during the previous winter and which required special handling for their removal. These rocks were taken out and the end of the bar dredged off 5 feet below low water, widening the channel 120 feet for a distance of 1,080 feet.

Most of the material excavated was dumped along the West Virginia shore above Mill Creek Island bar, the remainder being placed along the Ohio shore about three-fourths mile above Mill Creek.

The work was not completed, being interrupted by low water.

Excavation made, July 22 to August 11:

Gravel, bowlders, and loose rock	cubic yards	12,057.0
Rocks removed (46)	tons	66.8

Matamoras, W. Va. (142 miles below Pittsburg).—On August 2 one snag was removed from the channel at the steamboat landing.

Snag removed (1)	tons	7.4

Reas Run bar, Ohio (150.8 miles below Pittsburg).—This obstruction is a gravel bar which interferes with descending tows, forcing them so far out into the river that they have difficulty in avoiding the bar at the head of Grape Island, just below.

The point of the bar was dredged off 5 feet below low water, widening the channel 70 feet for a distance of 680 feet.

The excavated material was dumped along the West Virginia shore above the island bar. The work was not completed, being interrupted by low water.

Excavation made, August 3 to 12:

Gravel and bowlders	cubic yards	8,233.0
Logs and snags removed (1)	tons	1.0
Rocks removed (1)	do	1.8

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Ohio River bar (opposite mouth of Muskingum River, 171.5 miles below Pittsburg).—This bar of light gravel, which made the channel past the mouth of the Muskingum very crooked and narrow at ordinary boating stages, had long been a cause of trouble and loss to descending tows and delay to ascending tows and packets.

The whole of the bar was removed to the line of the old riprap dike which extends below Marietta Island, straightening the channel and widening it 380 feet, 5 feet below low water, for a distance of 1,500 feet, thus affording safe and easy navigation at this point.

A number of large logs and timbers were removed from the channel at the lower end of the bar, the largest log having a weight of 31.2 tons.

The excavated material was dumped along the West Virginia shore below Williamstown.

Excavation made, October 14 to December 9:

Gravel and sand	cubic yards	80,300.0
Logs and snags removed (183)	tons	186.5
Rocks removed (1)	do	2.2
Wrecks removed		1

MUSKINGUM RIVER, OHIO.

Muskingum River bar (mouth of Muskingum River, 171.5 miles below Pittsburg).—The approved estimate for operating and care of the Muskingum River for the year ending June 30, 1905, contained an item of $9,900 for removing the bar at the mouth of the river. No other dredges being available, and operations on the Ohio River being interrupted by low water, this work was assigned to the Ohio River plant, which began operations under orders to do as much of it as possible while low water prevented work in the Ohio River.

As the low-water season proved to be of unusual duration, lasting from the middle of August until after the river had frozen over in December and making it impracticable to move the plant to any Ohio River work away from Marietta, operations in the Muskingum were continued after the original project had been completed; widening the harbor by removing the row of old piles and other obstructions along the right bank, and also the bar there between the Muskingum and Ohio rivers, thus making the full width of the river below the railroad bridge available as a harbor of refuge.

The whole of the river below the Baltimore and Ohio Railroad bridge was dredged out 5 feet below low water; the area covered having an average width of 600 feet and length of about 1,000 feet.

A large part of the bar in the Muskingum consisted of loose rock, former filling of Dam No. 1, which had been carried down by the current at various times when the dam had broken. Many logs, timbers, and large rocks, and one coal-barge wreck were found in the bar and removed.

The excavated material was dumped in the Ohio River along the West Virginia shore below Williamstown.

Excavation made August 22 to November 11:

Gravel, sand, etc	cubic yards	92,029.0
Gravel, bowlders, and loose rock	do	27,305.0
Logs and snags removed (224)	tons	103.6
Rocks removed (65)	do	116.1
Piles removed		431
Wrecks removed		1

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Lock No. 1, Marietta, Ohio (171.5 miles below Pittsburg).—The dredge *Ohio* was employed December 6 to 8 in removing sediment from the lock, where for a distance of 62 feet above the middle gates the chamber was cleared of a mud deposit 12 feet deep.

Excavated material was dumped close above Dam No. 1.

Excavation made December 6 to 8:

Mud	cubic yards	1,680.0

After completing work on the Ohio River bar, as the river was partly frozen over and still too low for the plant to reach any other work, the dredges went into winter quarters in the harbor at mouth of the Muskingum. The dredge tender *Annie L.* was discharged on December 9, and on December 15, after having put the plant in order for winter, the crews, with exception of four men needed to care for it and to make some repairs, were discharged.

When operations were suspended at the close of last season the dredging plant was laid up in the mouth of Muskingum River where it remained in safety during the winter in charge of a small force of men who in addition to the usual care of such a plant gave the machinery of the dredges an overhauling and made such repairs to it as were rendered necessary after a season of work.

The hull of the *Ohio* is 24 years old and has only been out of the water once. In 1896 it was pulled out on the ways at Cincinnati to make some changes in spud boxes and replace two bottom plates which had been cut through by striking rock during low-water work in 1895.

Two holes were cut through the hull during travel and another while at work at the mouth of Muskingum River during 1904.

Examination developed that at the breaks the metal was reduced by wear and corrosion to a thickness of one-eighth of an inch. The original thickness of bottom plates was three-eighths of an inch, and of those on sides and rakes below water line seven-sixteenths of an inch.

It was deemed unsafe to undertake another season's work without extensive repairs, and it was decided to not only renew the bottom plating and side and rake plating below the water line, but to lengthen the hull 18 feet, and strengthen the longitudinal frames by riveting one-fourth by 10 inch plates along the under edge. This will increase the depth of hold 7.5 inches and raise the crane shelf that much higher out of the water, thus making it possible to dredge a shallower cut than is now practicable, a matter of much importance during low-water work. Increasing the length of hull will reduce the draught about 7 inches and thus facilitate low-water travel.

The estimated cost of the proposed repairs and alterations was $9,500. The work having been authorized, specifications were prepared and proposals invited. Preparations for docking were made by removing the crane, wire ropes, forward spuds, and the coal bunker.

No bids were received for doing the work. It was therefore decided to purchase the necessary material under emergency contract, and advertise for the work of repair, using the United States dry dock at Louisville, Ky., for docking the dredge.

During April and May the plant was prepared for the season's work by calking and repair of scows and flatboats, some necessary painting of dredges and other general repairs. The old No. 4 scow

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was docked at Parkersburg, W. Va., for repair and calking below the water line.

Temporary repairs were made to the *Ohio* to fit her out for work, with careful handling, until the radical repairs can be undertaken.

Proposals for furnishing a towboat for dredge tender during the present season were opened on May 10, and the lowest bid, that of the Burnside and Burkesville Transportation Company, of Burnside, Ky., $38.85 per day, was accepted.

The dredge tender reported for duty on June 6 and on June 7 the fleet left Marietta and proceeded up the river to Blair Run bar, Fish Creek Island, 113 miles below Pittsburg, Pa.

This bar projected into the river from the right shore and interfered with navigation. The improvement consisted in removing the outer end of the bar so as to straighten the channel. Some work was done here during the season of 1904, but high water stopped operations before the improvement was completed.

The cuts made last year were extended into good water and ridges were leveled off.

The material removed, loose rock and gravel, was dumped to the left of the channel near the lower end of Fish Creek Island.

Excavation made June 12 to 16:

Loose rock and gravel	cubic yards	5,362

After completing the work at Blair Run bar the plant was moved to Opossum Creek bar, 119.7 miles below Pittsburg, Pa., where the channel was narrow and crooked.

The work undertaken is to dredge on both sides of the channel so as to widen and straighten it. This work is now in progress.

The material removed, sand and gravel, was dumped below Opossum Creek bar near the Ohio shore.

Excavation made June 17 to 30:

Sand and gravel	cubic yards	9,670

A petition with respect to the dredging considered necessary on the upper section of the river was received in May, 1905, from the Association of Masters and Pilots of Steam Vessels of Pittsburg, Pa., signed also by four of the largest coal firms, urgently requesting dredging at various localities between Pittsburg and Cincinnati. In order to ascertain the actual needs more definitely, Mr. J. N. Caldwell, assistant engineer, was directed to consult the petitioners and examine the places named. Although the stage of river encountered was not suitable for a careful inspection, the result showed that navigation would derive great benefit from the work requested.

During past seasons the United States dredges have been employed at most of the places referred to, but owing to the numerous places demanding such work, the changes in channel from time to time, and other causes, much desirable work is necessarily postponed.

The great length of the Ohio River makes it impossible with the present plant to render satisfactory work of dredging. The constant calls by the coal interests for work at large and small places in the upper river is balanced by equally urgent claims for packet channels to be excavated at low water through the long flat bars of the lower river. To do justice to the subject there should be a number of plants.

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These plants will be necessary whatever the scheme of improvement may be, and no better use could be made of the funds for the general improvement of the Ohio River than to procure and operate a series of dredges which can be used at low water for assisting navigation during the late summer and fall. An estimate to that end is made in this report, and it is earnestly urged that this request be supported.

OHIO RIVER DREDGING STATEMENT FOR 1904.

Dredges in commission.

TIME.

Time at work.	Days.	Time lost.	Days.
Dredging gravel, sand, etc	56.1	Sundays	26.0
Dredging gravel, bowlders, and loose rock	30.5	Holidays	3.0
Dredging gravel and bowlders	8.0	Traveling	11.4
Dredging mud	1.5	Coaling	4.8
Removing logs and snags	6.9	High and low water	9.2
Removing rocks	3.4	Accidents	16.4
Removing piles	1.5		
Removing wrecks	.3	Total	70.8
Total	108.2		

Total in commission, 179 days.

WORK.

Nature of work.	Per day of work.	During the season.
	Cu. yds.	*Cu. yds.*
Gravel, sand, etc., excavated	3,071.8	172,329
Gravel, bowlders, and loose rock excavated	2,722.3	88,031
Gravel and bowlders excavated	2,599.1	20,793
Mud excavated	1,120.0	1,680
Total excavation for the season		277,833

	Number.	Tons.
Logs and snags removed	411	300.5
Rocks removed	120	201.0
Piles removed	431	
Wrecks removed	2	

COST.

Equipment for the season	$1,188.91
Towing and fuel for the season	13,613.07
Repairs for the season	1,031.78
Salaries for the season	9,261.06
Total for the season	25,094.82

Dredges out of commission.

TIME.

	Days.
In ordinary	120
Annual repairs	66
Total	186

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COST.

Salaries in ordinary	$3,187.40	
Fuel in ordinary	192.25	
Total in ordinary		$3,379.65
Salaries during annual repairs	3,404.43	
Annual repairs (shop bills, materials, etc.)	3,029.59	
Total cost of repairs		6,434.02
Total out of commission		9,813.67
Cost per day in ordinary (including superintendent's pay)		28.16

Cost of work, including all expenditures in 1904.

Dredging gravel, sand, etc	$18,099.51
Dredging gravel, bowlders, and loose rock	9,840.20
Dredging gravel and bowlders	2,581.04
Dredging mud	483.94
Removing logs and snags	2,226.13
Removing rocks	1,096.94
Removing piles	483.94
Removing wrecks	96.79
Total expenditure in 1904	34,908.49

COST PER UNIT.

Per cubic yard of excavation	$0.112

The day of work is for eight hours' actual operation of two dredges with four dump scows and two towboats for tenders, deducting every hour lost by accident or otherwise.

The towboat *Annie L.*, chartered as the regular dredge tender for the season, was paid $44.64 per day, this amount covering the cost of the boat, with outfit, crew, and fuel for the towboat and dredges, except that all cost of coal in excess of 5 cents per bushel was repaid by the Government.

The expenditure for towing includes $4,720 paid for operating expenses of the U. S. S. *Gen'l O. M. Poe* and for hire of additional towboats, two tenders being needed during the whole season in order to dispose of the excavated material, as it was found impossible for one towboat to keep the dredges busy.

The "total expenditure," on which the cost of work is based, covers all outlay properly applicable to the season of 1904, including the cost of superintendence, office work, etc.

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Location and description of work.

Place.	Miles from Pittsburg.	Date.	Days of work.	Logs and snags.		Rocks.		Piles.	Wrecks.	Gravel, sand, etc.	Gravel, bowlders, and loose rock.	Gravel and bowlders.	Mud.	Per day of work.	Cost per cubic yard.	Total cost for 1904.
				Number.	Tons.	Number.	Tons.									
		1904.								*Cu. yds.*	*Cu. yds.*	*Cu. yds.*	*Cu. yds.*	*Cu. yds.*		
Coon Run bar	114.9	June 14–July 7	9.1								24,680.0			2,706.0	$0.119	$2,995.98
Do	114.9	June 27–July 7	.2			4	6.8									64.53
Blair Run bar	113.0	June 22–July 8	6.0								16,950.0			2,825.0	.114	1,935.78
Do	113.0	June 28–July 6	.2			2	5.6									64.53
Do	113.0	June 29–30	.1	2	2.0											32.26
Short Creek bar	81.0	July 15–18	1.1								2,089.0			1,899.1	.169	354.89
Do	81.0	July 16	.1			1	2.2									32.26
Barnes Run bar	133.6	July 20–Aug. 1	4.8									12,560.0		2,616.7	.123	1,548.62
Mill Creek bar	141.0	July 22–Aug. 11	5.3								12,057.0			2,274.9	.142	1,709.94
Do	141.0	July 22–Aug. 10	1.2			46	66.8									387.16
Matamoras, W. Va	142.0	Aug. 2	.1	1	7.4											32.26
Rees Run bar	150.8	Aug. 8–12	3.2									8,233.0		2,572.8	.125	1,032.42
Do	150.8	Aug. 11	.1			1	1.8									32.26
Do	150.8	Aug. 3	.1	1	1.0											32.26
Ohio River bar, opposite mouth of Muskingum River	171.5	Oct. 14–Dec. 9	24.6							80,300.0				3,264.2	.099	7,936.68
Do	171.5	Oct. 17	.1			1	2.2									32.26
Do	171.5	Oct. 14–Dec. 8	3.5	183	186.5											1,129.20
Do	171.5	Dec. 2–5	.1						1							32.26
Mouth of Muskingum River	171.5	Aug. 22–Nov. 11	31.5							92,029.0				2,921.6	.110	10,162.83
Do	171.5	Sept. 15–Oct. 18	9.0								27,305.0			3,033.9	.106	2,903.66
Do	171.5	Sept. 3–Nov. 10	1.5			65	116.1									483.94
Do	171.5	Aug. 23–Nov. 11	3.1	224	108.6											1,000.15
Do	171.5	Sept. 28–Oct. 13	1.5					431								483.94
Do	171.5	Sept. 14–20	.2						1							64.53
Lock No. 1, Muskingum River	171.5	Dec. 6–8	1.5										1,680.0	1,120.0	.280	483.94
Total			108.2	411	300.5	120	201.0	431	2	172,329.0	83,061.0	20,793.0	1,680.0			84,908.49

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ESTIMATE.

The balance of the funds now available will be applied during the fiscal years 1906–7 in accordance with the project as follows:

Repairing low dikes and dams, Browns Island, Marietta Island, Newberry Island, Rising Sun	$10,500.00
Dikes, Mound City, Ill. (contract)	38,000.00
Ice pier, Gallipolis, Ohio (contract)	12,300.00
Ice pier, Maysville, Ky. (contract)	11,400.00
Supervision of harbor lines at Steubenville, Ohio, Wheeling, W. Va., Ironton, Ohio, Cincinnati, Ohio, Secretary of War permits, and examinations of encroachments on the general river	10,000.00
Repairs to quarter boats, etc	1,000.00
Minor examinations and surveys	10,000.00
1 steel-hull dredge, with equipment	30,000.00
2 dump scows	10,000.00
1 fuel flat	2,000.00
1 steel or composite hull towboat, including equipment	20,000.00
Dredging operations, United States dredges, and ordinary repairs to same, viz: 2 dredges, fiscal years 1906–7; 1 new dredge, fiscal year 1907; 1 new towboat, fiscal year 1907	112,000.00
Special repairs to dredge *Ohio*	9,500.00
Dredging, under contract, harbor below ice pier, Middleport, Ohio	13,000.00
General administration, engineering, inspection, storage, etc	36,000.00
Contingencies	22,126.27
Total	347,826.27

ESTIMATE FOR APPROPRIATION.

For further operations under the general project of improvement and for procuring and operating an additional working plant for open-channel improvement additional funds are urgently needed, as indicated in the money statement below, and the appropriation of that sum is recommended with all permissible force.

Low dikes and dams:	
1 stone and concrete dam at head of Browns Island to replace existing timber crib structure	$27,000
1 stone and concrete dam at head of Marietta Island to replace existing timber crib structure	32,400
1 loose stone dike at the head of Grand Chain	30,000
Ice piers: 3 sections of concrete ice pier at Cincinnati, Ohio	37,000
Supervision of harbor lines at Steubenville, Ohio, Wheeling, W. Va., Ironton, Ohio, Cincinnati, Ohio, Secretary of War permits, and encroachments on general river (two years)	10,000
Minor examinations and surveys (two years)	10,000
Dredging operations:	
2 steel hull dredges, with equipment, at $30,000	60,000
4 dump scows, at $5,000	20,000
2 fuel flats, at $2,000	4,000
Operating and repairs 3 dredges two years; Operating and repairs 2 dredges one year	171,800
General administration, engineering, inspection, storage, etc. (two years)	50,000
Contingencies	47,800
Total	500,000

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Money statement.

July 1, 1904, balance unexpended		$230,454.40
Amount appropriated by river and harbor act approved March 3, 1905		208,200.00
October 10, 1904, amount received for lost transit		200.00
June 16, 1905, amount received from sale of maps		4.25
March 16, 1905, amount received from appropriation for operating and care of canals, etc., Muskingum River		9,900.00
April 29, 1905, amount received from appropriation for operating snag boats on the Ohio River		3,742.48
		452,501.13
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$49,754.58	
For maintenance of improvement	36,806.48	
		86,561.06
July 1, 1905, balance unexpended		365,940.07
July 1, 1905, outstanding liabilities		2,240.14
July 1, 1905, balance available		[a] 363,699.93
July 1, 1905, amount covered by uncompleted contracts		47,653.10
Amount (estimated) required for completion of existing project		Indefinite.
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905		500,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.		

Statement of amounts and dates of all appropriations for this work.

Act of Congress.	Appropriation.	Allotment.	Remarks.
March 3, 1827	$30,000.00		
March 3, 1835	50,000.00		
July 2, 1836	20,000.00		
March 3, 1837	60,000.00		
July 7, 1838	50,000.00		
June 11, 1844	100,000.00		
March 3, 1847	6,479.25		
August 30, 1852	90,000.00		
June 23, 1866		$172,000.00	Improving Mississippi, Missouri, Arkansas, and Ohio rivers.
Do		80,000.00	Snag boats and apparatus for improving Western rivers.
March 2, 1867	100,000.00		
July 25, 1868		85,000.00	Repair, preservation, extension, and completion of river and harbor works.
July 11, 1870	50,000.00		
March 3, 1871	50,000.00		
June 10, 1872	200,000.00		
March 3, 1873	200,000.00		
June 23, 1874	150,000.00		
March 3, 1875	300,000.00		
August 14, 1876	175,000.00		
June 18, 1878	300,000.00		
Do	50,000.00		Harbor of refuge at or near Cincinnati.
March 3, 1879	250,000.00		
June 14, 1880	250,000.00		
March 3, 1881	350,000.00		
March 21, 1882	100,000.00		Continuing work on Davis Island Dam.
August 2, 1882	350,000.00		
Do	16,000.00		Harbor of refuge near Cincinnati, Ohio.
July 5, 1884	600,000.00		
Do	17,000.00		Do.
August 5, 1886	375,000.00		
August 11, 1888	380,000.00		
September 19, 1890	300,000.00		

[a] Fifteen thousand eight hundred and seventy-three dollars and sixty-six cents of this balance pertains to ice piers at Middleport, Gallipolis, and Maysville, which can only become available by special legislation of Congress.

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Statement of amounts and dates of all appropriations for this work—Continued.

Act of Congress.	Appropriation.	Allotment.	Remarks.
January 19, 1891	$2,128.87		Relief of Stubbs & Lackey. Treasury settlement No. 2593.
July 13, 1892	360,000.00		
August 18, 1894	250,000.00		
June 3, 1896	250,000.00		
July 1, 1898		$15,000.00	For restoring levee and banks of Ohio River at or near Shawneetown, Ill.
March 3, 1899	375,000.00		
June 13, 1902	359,000.00		Amount appropriated, $400,000, $41,000 being for Falls of Ohio River, at Louisville, Ky.
July 1, 1902	25,000.00		Between Cairo and Mound City.
March 3, 1905	208,200.00		Amount appropriated, $200,000, $20,800 being for dredging in pool 6, Ohio River, $56,000 for survey of Ohio River, and $15,000 for rock removal at head of canal at falls at Louisville, Ky.
Total	6,798,808.12	352,000.00	

Total of appropriations, 1827–1905	$6,798,808.12	
Total of allotments, 1827–1898	352,000.00	
Received from sales, etc., 1866–1905	8,202.03	
Received from Treasury settlement, 1904	261.45	
Transferred from other appropriations, 1905	13,642.48	
		$7,172,914.08
Appropriations not drawn, 1827, 1852	5,023.47	
Appropriation not drawn, 1902 (between Cairo and Mound City)	25,000.00	
Allotments not drawn, 1866, 1868	43,134.60	
Returned by Treasury settlements	30.07	
Amount transferred to other works	125,168.44	
		198,356.58
Total		6,974,557.50

ABSTRACT OF CONTRACTS IN FORCE DURING THE FISCAL YEAR ENDING JUNE 30, 1905.

Name of contractor: New Haven Towboat Company.
Amount and character of work: $7,856.63. Hire of towboat and crew as tender to United States dredges.
Price per unit: $44.64 per day.
Date of approval: June 7, 1904.
Date of beginning: June 11, 1904.
Date of expiration: About December 1, 1904. Completed.

Name of contractor: S. N. Galbreath.
Amount and character of work: $504. Hire of flatboat.
Price per unit: $6 per day.
Emergency contract dated September 14, 1904.
Date of beginning: September 24, 1904.
Date of expiration: Until discharged at close of working season. Completed.

Name of contractor: S. N. Galbreath.
Amount and character of work: $783.20. 376 cubic yards stone for Ohio River dikes, and hire of flatboat.
Price per unit: $0.95 per cubic yard; flatboat, $6 per day.
Emergency contract dated September 14, 1904.
Date of beginning: September 19, 1904.
Date of expiration: When all stone is delivered. Completed.

Name of contractor: The Fridman Lumber Company.
Amount and character of work: $2,489.19. 106,376 feet B. M. oak timber for Eightmile dike, Ohio River.
Price per unit: $23.40 per 1,000 feet B. M.
Emergency contract dated September 15, 1904.
Date of beginning: September 16, 1904.
Date of expiration: December 13, 1904. Completed.

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Name of contractor: Frank J. Duvall.
Amount and character of work: $1,366.13. 738 cubic yards stone for dam at head of Buffington Island, Ohio River.
Price per unit: $1.85 per cubic yard.
Emergency contract dated September 30, 1904.
Date of beginning: October 10, 1904.
Date of expiration: 60 days from commencement. Completed.

Name of contractor: D. P. Price.
Amount and character of work: $1,205.94. 1,205.94 cubic yards stone for dam at head of Marietta Island, Ohio River.
Price per unit: $1 per cubic yard.
Emergency contract dated October 29, 1904.
Date of beginning: November 2, 1904.
Date of expiration: 30 days from commencement. Completed.

Name of contractor: Queen City Marine Railway Company.
Amount and character of work: $200. Rent of storage room.
Price per unit: $20 per month.
Emergency contract dated March 21, 1905.
Date of beginning: March 1, 1905.
Date of expiration: December 31, 1905.

Name of contractor: Burnside and Burkesville Transportation Company.
Amount and character of work: $6,400. Hire of towboat and crew as tender to United States dredges.
Price per unit: $38.85 per day.
Date of approval: June 21, 1905.
Date of beginning: June 6, 1905.
Date of expiration: About December 1, 1905.

Name of contractor: W. F. Robertson Steel and Iron Company.
Amount and character of work: About $3,000. Steel plates, etc., for use in repairing hull of U. S. dredge *Ohio*.
Price per unit of 100 pounds: ⅛-inch plates, at $2.015; $\frac{3}{16}$-inch plates, at $1.915; plates under 14 by ¼ inch and heavier, in lengths up to 20 feet, at $1.865; in lengths over 20 feet, at $1.965; plates wider than 14 by ¼ inch and heavier, in lengths up to 20 feet, at $1.815; in lengths over 20 feet, at $1.965; angles, at $1.78; channels in lengths up to 20 feet, at $1.78, in lengths over 20 feet, at $1.88.
Emergency contract dated June 8, 1905.
Date of expiration: September 15, 1905.

Name of contractor: Parkersburg Dock Company.
Amount and character of work: $900.60. Docking and repairing boats.
Price per unit: For docking, $75; Oregon fir lumber, at $50; and white-oak lumber, at $45 per 1,000 feet B. M.; spikes, nails, driftbolts, and screw bolts, $0.045 per pound; navy oakum and calking cotton, at $0.18 per pound; red lead, mixed, at $0.15 per pound; labor of eight hours per day, foreman, $5; carpenters, calkers, and painters, $3; laborers, $2.
Emergency contract dated June 14, 1905.
Date of beginning: June 21, 1905.
Date of expiration: 6 weeks from date of commencement.

Name of contractor: Oscar F. Barrett.
Amount and character of work: $37,212.50. Extension and repair of dikes in Ohio River at Mound City, Ill.
Price per unit: Stone, 6 to 10 cubic feet each, at $3.25 per cubic yard; ¾ to 1½ cubic feet each, at $2.70 per cubic yard.
Date of approval: June 23, 1905.
Date of beginning: July 1, 1905.
Date of expiration: 200 fair working days after date of commencement.

STAGES OF OHIO RIVER IN 1904.

The following are the records of the gauges at Pittsburg, Cincinnati, and Evansville, which may be taken to represent the navigable condition of the upper, middle, and lower Ohio:

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Gauge at Davis Isalnd dam, near Pittsburg, Pa.

[When the dam is up, low-water readings must be obtained from the gauge at the lower end of the lock. On this gauge 3 feet 2 inches corresponds to a navigable depth of 3 feet, and 6 feet corresponds to the same depth in the river.]

Month.	Depth in channel.			Gauge readings.	
	Under 3 feet.	3 feet and over.	6 feet and over.	Highest.	Lowest.
1904.	*Days.*	*Days.*	*Days.*	*Feet.*	*Feet.*
January	0	31	13	26.9	4.0
February	0	29	20	18.4	4.0
March	0	31	31	24.8	7.1
April	0	30	30	21.2	6.0
May	0	31	22	11.8	4.7
June	0	30	12	9.8	3.7
July	0	31	9	10.7	3.3
August	17	14	0	3.8	2.3
September	27	3	0	3.6	1.9
October	13	18	0	4.5	2.6
November	27	3	0	3.4	1.9
December	25	6	6	12.3	1.5
Total	109	257	148		

Cincinnati gauge.

[The zero of this gauge is about 2 feet below low water; readings of about 4 feet correspond to about 3 feet in the channel, and those of 7 feet to about 6 feet in the channel.]

Month.	Depth in channel.			Gauge readings.	
	Under 3 feet.	3 feet and over.	6 feet and over.	Highest.	Lowest.
1904.	*Days.*	*Days.*	*Days.*	*Feet.*	*Feet.*
January	0	31	31	43.6	10.7
February	0	29	29	30.2	13.0
March	0	31	31	45.9	19.7
April	0	30	30	44.3	14.8
May	0	31	31	33.9	10.7
June	0	30	30	26.0	9.7
July	0	31	31	22.3	7.1
August	0	31	16	7.3	5.4
September	0	30	6	6.8	3.7
October	0	31	0	4.9	3.3
November	0	30	0	5.5	3.7
December	0	31	1	11.8	3.4
Total	0	366	286		

Evansville gauge.

[The zero of this gauge is about at low-water line. Readings of 2 feet correspond to about 3 feet in the channel, and readings of 6 feet correspond to about 6 feet in the channel.]

Month.	Depth in channel.			Gauge readings.	
	Under 3 feet.	3 feet and over.	6 feet and over.	Highest.	Lowest.
1904.	*Days.*	*Days.*	*Days.*	*Feet.*	*Feet.*
January	0	31	20	31.7	5.0
February	0	29	29	31.6	13.4
March	0	31	31	39.3	17.4
April	0	30	30	39.8	13.1
May	0	31	31	25.1	8.0
June	0	30	30	18.4	6.9
July	0	31	30	15.8	5.6
August	0	31	0	5.3	3.6
September	16	14	0	3.9	2.1
October	31	0	0	2.1	0.9
November	30	0	0	2.3	1.3
December	27	4	0	5.1	1.2
Total	104	262	201		

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STAGES OF THE OHIO RIVER.

Highest, lowest, and average stages of the Ohio River at Cincinnati each calendar year from 1860 to 1904, inclusive, with the highest stage during the floods of 1832 and 1847.

Calendar year.	Highest stage.		Lowest stage.		Average for the year.
	Month.	Stage.	Month.	Stage.	
		Feet.		*Feet.*	*Feet.*
1832	February	64.2			
1847	December	63.6			
1860	April	49.2	October	5.3	16.0
1861	do	49.4	July	5.1	19.1
1862	January	57.3	October	2.3	17.4
1863	March	42.7	do	2.5	15.0
1864	December	45.1	August	3.1	16.7
1865	March	56.2	October	5.7	21.8
1866	September	42.5	August	4.7	19.2
1867	March	55.7	October	3.0	17.0
1868	do	48.2	July	5.1	18.7
1869	April	48.7	August	5.3	19.7
1870	January	55.2	October	3.8	17.8
1871	May	40.5	do	2.7	11.8
1872	April	41.7	do	3.0	11.7
1873	December	44.4	do	3.7	18.4
1874	January	47.9	September	2.3	15.7
1875	August	55.8	do	4.2	18.7
1876	January	51.7	do	6.2	18.2
1877	do	53.7	October	3.2	15.0
1878	December	41.3	do	4.3	16.7
1879	do	42.7	do	2.5	14.5
1880	February	53.1	do	3.7	17.0
1881	do	50.6	September	1.9	16.9
1882	do	58.6	November	6.1	a 22.1
1883	do	66.3	September	3.6	a 19.5
1884	do	71.0	do	2.7	a 17.3
1885	January	46.0	do	2.5	a 15.6
1886	April	55.7	November	3.3	a 17.8
1887	February	56.2	September	2.7	a 15.1
1888	April	39.9	August	5.2	a 17.9
1889	February	38.2	September	5.2	a 18.5
1890	March	59.2	August	5.7	a 25.7
1891	February	57.3	October	4.4	a 20.5
1892	April	43.7	November	3.4	a 16.5
1893	February	54.9	August	3.6	a 17.7
1894	do	35.6	September	3.1	a 12.9
1895	January	48.4	October	2.3	a 12.2
1896	April	47.8	September	5.5	a 16.7
1897	February	61.2	October	3.1	a 16.5
1898	March	61.4	do	4.5	a 19.7
1899	do	57.4	November	3.4	17.1
1900	December	40.0	October	3.3	13.8
1901	April	59.7	November	4.2	17.6
1902	March	50.9	September	3.9	16.8
1903	do	53.1	October, November.	4.5	17.9
1904	do	45.9	October	3.9	14.6

[a] Prepared from the stages as shown by the waterworks marks daily at 6 a. m. and 6 p. m., the previous and succeeding years having been made from one daily observation at 6 a. m.

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MONTHLY COMPARISONS OF RIVER AND RAINFALL.

Highest, lowest, and average monthly stages of the Ohio River and monthly and annual rainfall at Cincinnati in two years ending December 31, 1903 and 1904.

Months.	Highest.				Lowest.				Average.		Rainfall.	
	1904.		1903.		1904.		1903.		1904.	1903.	1904.	1903.
	Date.	Feet.	Date.	Feet.	Date.	Feet.	Date.	Feet.	Feet.	Feet.	Inches.	Inches.
January	28	43.6	8	37.0	4	10.7	22–23	14.7	19.4	23.1	2.66	2.05
February	13	30.2	8,20	49.4	21	13.0	1	23.2	20.3	39.7	2.66	5.67
March	9	45.9	5	53.1	22	19.7	23	26.2	34.6	42.5	8.17	5.06
April	1	44.3	19	44.4	25	14.8	29	22.8	26.6	32.9	2.28	3.33
May	2	33.9	1	23.0	20	10.7	25	7.6	20.1	12.0	3.70	3.72
June	9	28.8	30	17.7	22–23	9.7	19	10.3	16.2	13.5	2.60	3.54
July	13	22.3	1	17.1	31	7.1	24	9.3	13.4	12.7	.80	2.25
August	5	7.3	1	9.1	19–20	5.4	29	5.0	6.3	6.7	.41	2.78
September	2–3	6.8	6	14.3	29–30	3.7	1	5.1	5.0	8.2	1.28	1.81
October	25–26	4.9	16	11.7	6–7	3.3	7	4.5	3.3	6.6	.89	1.31
November	4	5.5	24	16.5	23, 28–30	3.7	11–16	4.5	4.2	7.3	.34	1.45
December	31	11.8	29	22.8	10	3.4	12–13	5.3	4.6	9.6	3.75	1.72
For the year.	[a]9	45.9	[a]5	53.1	[b]6–7	3.3	[b]7 / [c]11–16	4.5	14.6	17.9	29.54	34.69

[a] March. [b] October. [c] November.

Losses by collision with bridges.

The following table shows the reported losses sustained by the commerce of the Ohio River by collision with the piers of bridges crossing the Ohio River to the end of the calendar year 1904:

Date, etc.	Owner.	Steamboat.	Loss.	Amount.
Steubenville bridge:				
Previously reported				$123,758
January 26, 1904	The Monongahela River Consolidated Coal and Coke Co.	James Moren	1 coal boat	2,000
Do	do	Fred Wilson	do	2,000
Do	do	J. A. Wood	1 coal boat, 1 barge, and 1 flat.	4,000
Total				131,758

NOTE.—The above losses were reported by Mr. J. Frank Tilley, secretary Pittsburg Coal Exchange.

Losses by collision with Ohio River bridges to December 31, 1904.

Ohio connecting railway bridge	$3,500.00
Beaver bridge	91,140.00
East Liverpool bridge	1,500.00
Steubenville bridge	131,758.00
Wheeling and Martins Ferry bridge	12,150.00
Bellaire bridge	150,126.00
Parkersburg bridge	111,748.47
Point Pleasant bridge	9,650.00
Kenova bridge	64,450.00
Newport and Cincinnati railway and highway bridge	48,107.00
Newport and Cincinnati highway bridge	750.00
Covington and Cincinnati railroad bridge	95,700.00
Cincinnati Southern bridge	14,812.00
Louisville and Jeffersonville bridge	7,800.00
Ohio Falls bridge	202,850.00
Kentucky and Indiana bridge	34,267.00
Henderson bridge	37,160.00
Cairo bridge	32,419.95
Total	1,049,888.42

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COMMERCIAL STATISTICS.

Commerce of Ohio River in 1904.

[Compiled from reports made by owners, agents, and masters of vessels and transportation companies, in compliance with act of Congress approved February 21, 1891—Public No. 92.]

Name of boat or company.	Terminal points.	Distance.	In commission.	Freight.	Passengers.
		Miles.	*Months.*	*Tons.*	
The Monongahela River Consolidated Coal and Coke Co.	Pittsburg to Cairo	965.0	12.0	2,371,732	
Huntington and St. Louis Towboat Co.	do	965.0	12.0	47,300	
Gordon C. Greene	do	965.0	9.0	17,978	16,863
Steamer Argand	do	965.0	5.0		750
Steamer Antoinette	do	965.0	10.0		40
Steamer Mary Stewart	do	965.0	5.0		620
Steamer Ben Hur	Pittsburg to Louisville	598.5	7.0	5,600	8,500
T. J. Hall	do	598.5	5.0	465,000	
C. Jutte & Co	do	598.5	12.0	283,900	
Steamer Kanawha	do	598.5	8.0	11,300	8,500
Steamer Avalon	Pittsburg to Madison	555.5	7.0	8,000	5,700
The A. R. Budd Coal Co	Pittsburg to Cincinnati	468.0	7.0	108,771	
Clyde Coal Co	do	468.0	12.0	47,689	
Steamer Nellie England	do	468.0	9.0	236,425	
United Coal Co	do	468.0	1.0	20,261	
Steamer W. H. Flint	do	468.0	10.0	121,266	
Pittsburg and Cincinnati Packet Line.	do	468.0	5.0	21,413	20,442
Lewis Pope & Sons	Pittsburg to Parkersburg	184.0	2.0	9,688	
Steamer Lorena	Pittsburg to Marietta	171.0	5.0	4,500	5,700
John F. Klein	Pittsburg to Wheeling	90.0	6.0		39,618
Steamer F. K. Hulings	Pittsburg to Economy	17.0	12.0	225	100
Steamer Francis J. Torrance.	do	17.0	4.0		75,000
Steamer Steel Queen	Allegheny to McKees Rocks	3.0	12.0	2,246	311,460
Toronto Ferry Co	Toronto to Zailla	1.0	9.0		28,673
Steamer Cricket	Steubenville to Wheeling	22.5	4.5	6,700	2,175
Steamer Nathaniel	Steubenville to opposite shore	1.0	10.0		20,259
Steamer West End	Wellsburg to Brilliant	1.0	12.0	750	63,500
Steamer Gazelle	Martins Ferry to Bellaire	5.0	7.0	49,000	
Sheridan-Kirk Contract Co.	Wheeling to Paducah	880.0	11.0	24,540	
Steamer Scout	Wheeling to Cincinnati	378.0	9.0	140,000	
New Haven Towboat Co	do	378.0	10.0	332,400	
Steamer H. K. Bedford	Wheeling to Parkersburg	94.0	8.0	14,500	11,992
Steamer Bessie Smith	do	94.0	10.0	7,015	6,827
Steamer Elanora	Wheeling to Marietta	81.0	.5	700	65
Steamer Beaver	do	81.0	8.0	10,000	150
Steamer Hustler	do	81.0	10.0	500	300
Steamer Jewel	Wheeling to Newport	66.0	5.0	3,000	5,500
Steamer Ruth	Wheeling to Sistersville	47.5	6.0	1,522	6,241
Steamer Ruth, No. 2	do	47.5	6.0	2,728	7,411
Steamer Leroy	Wheeling to Clarington	27.5	7.0	7,350	9,442
Steamer Buckeye	Wheeling to West Wheeling	3.0	9.0	10,150	14,950
Steamer Charon	Bellaire to Benwood	1.0	10.0		306,308
Steamer Shifter	Sistersville to Marietta	34.0	6.0	1,800	2,500
Steamer T. N. Barnsdall	do	34.0	4.0	3,120	5,914
Steamer Orion	Sistersville to Tuels Landing	1.0	9.0	16,280	10,800
Steamer Grace Virginia	New Matamoras to opposite shore.	1.0	12.0		39,650
Steamer Geo. Gardiner	Marietta to Cincinnati	297.0	7.0	196,750	96
Steamer Valley Belle	Marietta to Middleport	80.0	8.5	8,363	1,935
Steamer Frank Tyler	Marietta to Parkersburg	13.0	6.0	40,000	
Steamer Pioneer City	Marietta to Williamstown	1.0	9.0	5,000	6,925
Steamer Mountain State	Parkersburg to Cincinnati	284.0	12.0	6,000	
Steamer Nina Paden	Parkersburg to Belpre	1.0	10.0	36,000	120,000
Steamer W. O. Hughart	Racine to Graham Station	1.0	12.0	1,880	10,800
Steamer Klondike	Syracuse to Gallipolis	25.0	9.0	745	4,568
Steamer Katie Mc	Pomeroy to Owensboro	499.5	8.0	16,000	540
Steamer Convoy	Pomeroy to Louisville	349.0	7.0	39,900	
The Campbells Creek Coal Co.	do	349.0	7.0	288,828	
The Cincinnati, Portsmouth, Pomeroy and Big Sandy Packet Co.	Pomeroy to Cincinnati	219.0	11.0	75,271	24,202
Steamer Champion, No. 3	Pomeroy to Mason	1.0	12.0	1,460	54,750
Collins & Hartweg Co	Point Pleasant to Louisville	334.0	10.0	154,550	88
Hatfield Coal Co	Point Pleasant to Cincinnati	204.0	5.0	120,000	
The Marmet Co	do	204.0	12.0	168,398	
Steamer Neva	Point Pleasant to Gallipolis	4.5	10.0	1,000	2,500

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Commerce of Ohio River in 1904—Continued.

Name of boat or company.	Terminal points.	Distance.	In commission.	Freight.	Passengers.
		Miles.	*Months*	*Tons.*	
Steamer Chevalier	Gallipolis to Huntington	39.0	7.0	4,075	12,000
Steamer Carrie Brown	do	39.0	8.0	5,732	14,825
Steamer Champion No. 2	Gallipolis to Steinbergen Landing.	1.0	10.0	3,000	22,500
Steamer M. B. Goble	Guyandotte to Catlettsburg	12.0	1.0	1,800	
Steamer Greyhound	Proctorville to Portsmouth	51.0	10.0	9,100	15,000
Steamer Arion	Proctorville to Guyandotte	1.0	9.0	12,000	14,000
C. Crane & Co	Huntington to Cincinnati	160.0	6.0	29,000	
Steamer City of Huntington.	Huntington to Rockwood	1.0	12.0		40,000
Big Sandy Towboat Co	Catlettsburg to Louisville	282.0	4.0	4,000	
Steamer Bonne	Catlettsburg to South Point	1.0	12.0	5,000	7,300
Steamer Bob Ballard	Ashland to Ironton	5.0	10.0	405,855	
Steamer Wenona	Ashland to Coal Grove	1.0	12.0		182,500
Steamer Ironton	Ironton to Russell	1.0	11.5	13,019	119,393
Steamer Emily	Portsmouth to Fullerton	2.0	4.0	120,000	6,000
Steamer W. H. Whiteman	Manchester to South Manchester.	1.0	12.0	78,792	42,000
Steamer Newt. Cooper	Manchester to Maysville	11.5	6.0	12,500	1,500
Steamer Addie T	Vanceburg to Cincinnati	91.0	3.5	22,979	410
Steamer Laurence	Maysville to Aberdeen	1.0	12.0	750	39,750
Steamer Proctor K. Smiley	Ripley to South Ripley	1.0	12.0	12,600	33,215
Steamer Whisper	Augusta to Boudes	1.0	9.0		7,590
Coney Island Co	New Richmond to Cairo and excursions.	516.0	1.0	225	75,508
Do	Coney Island to Cincinnati	9.0	3.0	650	465,574
Steamer New Richmond	New Richmond to South New Richmond.	1.0	12.0	11,412	15,837
Steamer F. A. Goebel	Blairsville to Cincinnati	16.5	5.0	500,000	
B. J. Riggs	do	16.5	9.0	190,000	
Smith Coal and Sand Co	Dayton to Addyston	17.0	10.0	208,000	
John Barrett & Son	Cincinnati to Cairo	497.0	5.0	40,700	
Lee Line	do	497.0	4.0	8,809	4,120
Steamer E. T. Slider	Cincinnati to Evansville	316.0	12.0	179,350	
Louisville and Cincinnati Packet Co.	Cincinnati to Louisville	130.0	11.0	131,901	113,647
Steamer Minnie	do	130.0	6.0	4,920	
Steamer Levi J. Workum	Cincinnati to Madison	85.0	12.0	8,300	3,612
Steamer Frank Miller	do	85.0	12.0	71,500	
Steamer Boone No. 5	Cincinnati to Constance	7.0	9.5	20,000	21,480
Steamer Swan	Aurora to Patriot	21.0	12.0	4,500	9,002
Steamer Eva Evartt	Vevay to Ghent	1.0	9.0	20,000	8,000
Louisville and Jefferson-ville Ferry Co.	Carrollton to Leavenworth	117.0	12.0		909,678
Steamer Falls City	Carrollton to Louisville	57.0	12.0	18,400	6,153
Steamer Golden Gate	Carrollton to Madison	14.0	1	13	6
Steamer White Dove	do	14.0	9.0	2,000	950
Steamer Trimble	Milton to Madison	1.0	12.0	7,300	18,250
Steamer Hanover	Madison to Bethlehem	14.5	12.0	5	5,022
Steamer William Duffy	Twelvemile Island to Louisville.	12.0	9.0	64,800	
Steamer Little Willie	Louisville to Cairo	367.0	12.0	28,140	
Steamer Conveyor	Louisville to Paducah	322.0	8.0	5,073	
Louisville and Evansville Packet Co.	Louisville to Henderson	196.0	8.5	94,437	10,293
Steamer Alma	Louisville to Evansville	185.0	10.0	13,047	736
Steamer Hiawatha	Portland to Riverview Park	2.0	10.0		56,786
The Marsden Co	Cloverport to Henderson	89.0	6.0	4,640	2,700
W. D. Crammond	Cannelton to Owensboro	32.0	11.0	7,040	29,100
Steamer Wabash	Rockport to Paducah	180.0	8.0	16,048	4,835
Steamer Neptune	Owensboro to Crofts Landing	127.0	12.0	21,266	
Robert Hornbrook	Owensboro to Shawneetown	99.0	10.0	125,500	22,375
Steamer D. A. Nisbet	do	99.0	8.0	20,850	25,162
John Archbold Coal Co	Newburg to Evansville	14.0	12.0	29,750	
Illinois Central Railroad Co.	Major to McLain	1.0	4.0	110,276	9,467
Steamer Kenois	Mouth Green River to mouth Wabash River.	162.5	12.0	10,395	
Steamer Old Reliable	Mouth Green River to Henderson.	19.0	12.0	22,250	400
Steamer Peerless	Mouth Green River to Evansville.	8.0	12.0	22,500	
Evansville and Bowling Green Packet Co.	do	8.0	12.0	35,000	10,500
Green River Coal Co	do	8.0	10.0	50,000	
Green River Mining, Manufacturing and Transportation Co.	do	8.0	12.0	22,500	
Steamer Harth	Evansville to Cairo	182.0	12.0	100,000	
Steamer Lula E. Warren	do	182.0	7.0	4,000	200
Steamer J. F. Buckham	Evansville to Paducah	137.0	12.0	25,306	406

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Commerce of Ohio River in 1904—Continued.

Name of boat or company.	Terminal points.	Distance.	In commission.	Freight.	Passengers.
		Miles.	*Months*	*Tons.*	
Evansville, Paducah and Cairo Line.	Evansville to Paducah	137.0	9.0	40,585	20,364
Nashville, Evansville and Paducah Packet Co.	....do	137.0	6.0	13,750	27,218
Steamer Jewel	Evansville to Henderson	11.0	10.0	10,000	73,000
Steamer Henderson	Henderson to opposite shore	1.0	12.0	610	4,640
Steamer Alfred D. Owen	West Franklin to Uniontown	25.0	8.0	9,533	10,720
Steamer New Haven	Mount Vernon to Elizabethtown	57.5	12.0	5,250	750
Steamer Ruth	Uniontown to Cairo	132.5	10.0	9,600	.....
Steamer Mary F. Golden	Mouth Wabash River to Brookport.	85.0	10.0	65,000	.....
Ayer & Lord Tie Co	....do	85.0	8.0	124,391	.....
Steamer Georgia	Shawneetown to Blackburn	1.0	5.0	.....	1,760
Dan Finnie	Dekoven to Cairo	106.0	12.0	66,105	.....
Ohio Valley Coal and Mining Co.	Dekoven to Paducah	61.0	8.0	4,922	.....
United States Gas, Coal and Coke Co.	Caseyville to Cairo	104.5	8.0	18,000	.....
Aberdeen Coal and Mining Co.	....do	104.5	7.0	32,912	.....
John S. Summers	Caseyville to Brookport	62.5	12.0	91,636	.....
Steamer Royal	Golconda to Paducah	30.0	11.0	5,280	9,960
Steamer Oscar F. Keeler	Smithland to Cairo	57.0	7.0	165,000	.....
The Holcomb-Lobb Co	Smithland to Joppa	28.0	9.0	42,127	120
Steamer Dick Fowler	Paducah to Cairo	45.0	10.0	22,500	45,000
Steamer Carrie V	....do	45.0	10.0	57,290	18
St. Louis and Tennessee River Packet Co.	....do	45.0	12.0	119,195	20,172
Steamer Monie Bauer	....do	45.0	2.0	13,500	.....
Steamer Charleston	Paducah to Joppa	16.0	6.0	2,000	420
Steamer Ten Broeck	....do	16.0	11.0	12,000	.....
E. J. Cowling	Paducah to Metropolis	9.0	12.0	6,840	41,675
Illinois Central Railroad Co	Paducah to Brookport	3.0	12.0	15,781	20,898
Steamer Lizzie B. Archbold	....do	3.0	10.0	603,700	38
Steamer Bettie Owen	....do	3.0	11.0	20,000	25,000
Steamer Charlotte Boeckler	Cairo to mouth of Ohio River	2.0	11.0	12,250	.....
Total				10,142,551	3,951,384

Coal shipments from Pittsburg, Pa., during calendar year 1904.

[Furnished by J. Frank Tilley.]

From Pittsburg, Pa., to—	Tons.
Cincinnati	948,944
Louisville	503,063
Mouth of river	1,277,313
Total	2,729,320

Shipments by months.

1904.	Tons.	1904.	Tons.
January	133,640	June	63,440
February	133,800	July	289,560
March	757,040	December	181,040
April	715,680		
May	475,120	Total	2,729,320

D D 2.

CONSTRUCTION OF LOCK AND DAM NO. 37, OHIO RIVER.

The general project for this work is printed in House Document No. 336, Fifty-seventh Congress, first session, and it was adopted by

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Congress in the river and harbor act of June 13, 1902, by appropriating $100,000 for commencing operations and authorizing their completion under the continuing-contract system at a total cost not exceeding $1,050,000. A description of the preliminary work in connection with the construction of the dam is given in Appendix F F 2 of the Report of the Chief of Engineers for 1903 and in Appendix D D 2 of the Report of the Chief of Engineers for 1904.

The plans and specifications for the lock and dam, with the machinery for operating dam, were approved August 18, 1904, the work was advertised August 27, and bids were opened September 27, 1904.

The Sheridan–Kirk Contract Company proved to be the lowest bidder, and after a slight modification in their bid contract was entered into October 27 and approved November 17, 1904.

The contract, which is estimated to aggregate about $796,152, covers all temporary work, such as cofferdams, etc., excavation, filling, and permanent protection to banks; the masonry, iron, and timber work of lock, navigable pass, bear traps, etc.; the air pipes, valves, etc.; also the foundations for permanent buildings. The work not included in the above contract is the steam and air machinery, electric-lighting plant, permanent buildings, and water supply; the cement will be furnished by the United States.

A temporary office building for use of the United States during the construction of the lock and dam was erected on the site during October, at a cost of $773.85, the work being done under emergency contract with John R. Steele, under date of August 31.

Owing to the lateness of the season when contract was approved, no work of construction was engaged in by the contractors until May, 1905, their operations prior to this date being confined to preliminary work in the building of a railroad siding from the Baltimore and Ohio Railroad tracks to the site of cement warehouse, erection of temporary buildings, derricks, etc., and in receiving, unloading, and assembling machinery and material required in the execution of the contract.

Clearing land.—The work of clearing the land belonging to the United States, on both sides of the Ohio River, has been completed with the exception of removing the stumps of trees.

Excavation.—The work of excavation has been in progress since April 7, and has been confined principally to dredging within the limits of the gate recesses, landlock wall and lower guide wall; a small amount of dredging has also been done in the abutment foundation.

The material removed consisted chiefly of sand and gravel, with some loose stone.

Filling.—About 8,920 cubic yards of material has been deposited directly by the dredge into the fill back of landlock wall during the progress of dredging operations; and about 540 cubic yards of earth have been placed in the terrace on Ohio shore 300 feet below axis of dam.

Cofferdam protection.—The work of driving piles and placing timber cribs in the cofferdam protection was begun May 25.

Cofferdam.—Work of driving piles for proposed cofferdam was begun May 25, and on June 30 a total of 529 cofferdam piles had been driven for the upper guide-wall coffer, the lock coffer, and the abutment coffer.

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About 128 linear feet of sheet piling have been driven in the upper guide cofferdam, and the top line of stringers have been placed on the upper guide coffer and on upper arm of lock coffer.

The material excavated in gate recesses and lower guide wall during the month of June was deposited in an embankment opposite lower guide wall, which has been proposed as a substitute for the timber cofferdam originally planned.

Ironwork, etc.—One carload of assorted bolts, two carloads of 18-inch I beams, and three carloads of iron castings, steel castings, and wrought-iron and steel parts for the bear traps, flushing conduits, and lock walls have been delivered at the site.

At the close of the fiscal year the following work entitling them to payment had been done by the contractors:

Temporary piling		118
Crib timbers	feet B. M.	64,533
Ordinary excavation	cubic yards	22,132
Stone filling	do	1,061
Ironwork delivered and paid for under paragraph 48 of specifications	pounds	316,728

Bids for 34,000 barrels of American Portland cement delivered at Fernbank, Ohio, were invited January 19 and opened February 21, 1905. Contract was made with the lowest bidder, the Atlas Portland Cement Company, April 7, and approved by the Chief of Engineers April 15, 1905. No deliveries of cement were made under this contract at the close of the fiscal year.

Money statement.

July 1, 1904, balance unexpended	$476,831.61
Amount appropriated by sundry civil act approved March 3, 1905	50,000.00
	526,831.61
June 30, 1905, amount expended during fiscal year, for works of improvement	17,775.70
July 1, 1905, balance unexpended	509,055.91
July 1, 1905, outstanding liabilities	387.73
July 1, 1905, balance available	508,668.18
July 1, 1905, amount covered by uncompleted contracts	835,989.12
Amount (estimated) required for completion of existing project	500,000.00

STATEMENT OF AMOUNTS AND DATES OF ALL APPROPRIATIONS FOR THIS WORK.

June 13, 1902	$100,000
March 3, 1903	400,000
March 3, 1905	50,000
Total	550,000

ABSTRACT OF CONTRACTS IN FORCE DURING THE FISCAL YEAR ENDING JUNE 30, 1905.

Name of contractor: John R. Steele.

Amount and character of work: $773.85. Construction of temporary office building at site of Dam No. 37, Ohio River.

Price per unit: $773.85; lump bid for whole work.

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Emergency contract dated August 31, 1904.
Date of beginning: September 6, 1904.
Date of expiration: 30 fair working days from date of commencement. Completed.
Name of contractor: Sheridan-Kirk Contract Company.
Amount and character of work: $796,152.70. Construction of Lock and Dam No. 37, Ohio River.
Price per unit: Cofferdam, 14 feet wide, $19.41 per linear foot; cofferdam, 18 feet wide, $20.45 per linear foot; cofferdam, 20 feet wide, $21.68 per linear foot; temporary piling, $15 per pile; crib timbers, $42 per 1,000 feet B. M.; clearing land, $150 per acre; ordinary excavation, $0.50 per cubic yard; deposit excavation, $0.65 per cubic yard; rock excavation, $2 per cubic yard; channel dredging, $0.10 per cubic yard; ordinary filling, $0.30 per cubic yard; stone filling, $2.50 per cubic yard; slope walls (dry stone), $3 per cubic yard; concrete masonry,[a] $4.29 per cubic yard; brick paving,[a] $1.34 per square yard; roadways, $1.20 per square yard; combination gutter curb,[a] $1 per linear foot; open gutter,[a] $0.70 per linear foot; catch basins,[a] $30 each; manholes,[a] $60 each; sewers,[a] $1.20 per linear foot; oak timber, $72 per 1,000 feet B. M.; pine timber, white, $80 per 1,000 feet B. M.; cast iron, $0.045 per pound; wrought iron and steel, $0.06 per pound; steel castings, $0.09 per pound; bronze, $0.21 per pound; babbitt metal, $0.15 per pound; yellow-pine timber, $54 per 1,000 feet B. M.; iron pipe, 3-inch diameter, $0.24 per linear foot; iron pipe, 4-inch diameter, $0.40 per linear foot; iron pipe, 6-inch diameter, $0.56 per linear foot; iron pipe, 8-inch diameter, $1.50 per linear foot; valves, 4-inch, $4.50 each; crosses, 4-inch, $1.75 each; tees, 4-inch, $0.70 each; elbows, 4-inch, $0.45 each; brass pipe, $0.40 per pound.
Date of approval: November 17, 1904.
Date of beginning: 30 days after notification of approval of contract.
Date of expiration: 350 fair working days after date of commencement.
Name of contractor: Atlas Portland Cement Company.
Amount and character of work: Cement in canvas sacks delivered at Fernbank, Ohio (17,000 barrels minimum, 51,000 barrels maximum).
Price per unit: $1.46 per barrel.
Date of approval: April 15, 1905.
Date of beginning: 15 days after notification of approval of contract.
Date of expiration: Contingent upon progress of work.

D D 3.

OPERATING SNAG BOATS ON THE OHIO RIVER.

The act of Congress of September 19, 1890, as modified by that of June 3, 1896, provided for yearly appropriations of $50,000 for this work. For phraseology of these acts and further details, see the Annual Report for 1896, Part 4, page 2093.

At the beginning of the fiscal year the U. S. snag boat *E. A. Woodruff* was in port at Cincinnati, where she remained inactive, owing to continued high stage of water until the 12th and was then ordered to resume general work on the lower section of the river. On reaching Louisville, however, another rise of the river precluded any prospect of effective work, and the snag boat returned to Cincinnati, remaining until the 28th, when she again started downstream. En route, the boat completed the removal, near Bethlehem, Ind., 570 miles below Pittsburg, of 8 coal boat and barge wrecks on which she had been engaged on her previous trip, but high water at that time prevented entire clearing of the channel. At Grassy flats, 17 miles above Louisville, soundings were made over the channel with a view to dredging urgently requested, navigation being seriously interfered with by the

[a] Cement to be furnished by the United States.

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shallow bars at this locality. The snag boat then continued her regular work over the river to the mouth, but the high stages during the earlier season had been followed by the opposite extreme and the passage was difficult at many points. The *Woodruff* arrived at the mouth of the river on August 15, whence she returned upstream, continuing removal of obstructions until arriving at Cincinnati on September 2. On account of low water operations until the 19th were confined to Cincinnati Harbor and the making of some necessary repairs to machinery. Between September 20 and 25 the snag boat again worked over the river to Louisville and return, and, as the stage was too low to permit ascending the river or going below Louisville, she remained in port at Cincinnati awaiting better conditions, the crew being utilized on repairs of machinery, scraping and painting interior of hull, and other general work for keeping the boat and outfit in proper condition. A small force was also detailed, and removed, by blasting, the wreck of a coal barge near the channel at the lower end of the city. Up to October 25 there was no prospect of early resumption of work, and on that date all members of the crew whose services could be dispensed with were furloughed without pay. During November a large snag in the channel near Huntington, W. Va., was reported with an urgent request for its removal while the stage of water was favorable, and the mate of the snag boat and a deck hand were sent to that point with tools and explosives and removed it on the 26th.

No change occurred in the extremely low stage of river which had prevailed for several months, and on the appearance of cold weather and ice in December, with a probability of their continuance, rendering general work on removal of obstructions impracticable, the snag boat was put in winter quarters at Cincinnati. The engine, running rigging, and exposed perishable property was stored away for care and safety, and the crew limited to the number necessary for proper care and safety of the boat.

Owing to the extreme severity of the ensuing portion of the winter a number of ice gorges formed in the river above, probably the heaviest ever known, which in passing out caused great damage to river craft generally; and although the danger had been anticipated and every precaution was taken for the safety of the snag boat, her hull, paddle wheels, and spar rigging sustained some injury. Throughout the month of March and up to April 24 the crew was employed on these and other necessary repairs, including the painting of the entire exterior of the boat; the latter being continued, during the subsequent wrecking operations, as opportunity afforded. Between April 24 and 27 the snag boat was engaged in Cincinnati Harbor and at Medoc bar, 16 miles below, in clearing the channel of 13 wrecks of coal boats and coal barges, sunk during the break-up of ice in March. At the end of the month repairs and painting were finished, and on May 1 the *Woodruff* proceeded direct to Marietta, Ohio, arriving on the 3d, and from that point worked downstream, reaching Cincinnati on the 12th. On the 13th she started direct for Pittsburg, reached that point on the 18th, having been seriously delayed by a broken crosshead. Regular work downstream was begun on the same date, and continued as far as Marietta, Ohio, 171 miles below, whence she was ordered back on the 24th to await a more favorable stage of river. At Clusters Island, 51 miles below Pittsburg, the low stage of falling

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river caused too much risk of long detention, and on the 25th work was again resumed downstream, continuing until June 8, when the boat reached Cincinnati. On this trip the *Woodruff* removed, above the ice piers at Gallipolis and Pomeroy, an accumulation of drift and débris aggregating 5,097 cords, and 11 large snags; and at Augusta, Ky., 4 wrecks previously passed to permit salvage by owners.

From June 8 to June 24 the river remained too high to permit work on obstructions—the gauge for most of this period standing at about 14 feet—and the boat remained in port at Cincinnati, the new crosshead of main engine and other repairs of machinery being in the meantime completed.

Work was resumed June 24 in Cincinnati Harbor, and on the 27th was continued downstream to Louisville, but the river being then too high, and rising, for effective work below, the *Woodruff* was ordered to return upstream until meeting a stage suitable for useful work, and at the end of June was at Madison, Ind., 555 miles below Pittsburg.

The total record of obstructions removed by the *Woodruff* during the fiscal year is as follows: 694 snags, aggregating in weight 3,086.36 tons; 8 rocks, measuring 2,261 cubic feet; 79 wrecks, comprising 39 coal barges, 29 coal boats, 3 flatboats, 2 fuel flats, 2 wharf boats, 1 sand boat, and the remains of 3 steamboats. From above the ice piers at Gallipolis and Pomeroy there were removed 5,097 cords of drift. Total number of miles run by the snag boat during the year, 3,825.

While the snag boat was laid up for low water and in winter quarters, from September 27, 1904, to April 24, 1905, miscellaneous repairs were made as follows: Removing and replacing with new one heavy reenforcing steel deck and side plate on the port bow, straightening 38 angle-bar top frames and drilling, and riveting in place on the starboard bow 56 linear feet of ¼-inch by 12-inch steel side plating, and rebuilding entirely both of the boat's large paddle wheels. The above damage to hull and wheels was occasioned by the ice break-up of the river on March 1, 1905. Repairs were also made to the large steam boilers and their furnace, refrigerating plant, cooking range, and exterior (only) painting of the boat.

The labor on the above repairs was generally performed by the crew of the boat.

The cost of the materials for the above stated repairs was as follows: Deck and side plate, port bow, $12; hull side, starboard bow, $27.35; paddle wheels (2), $136.71; boilers and furnace, $109.25; refrigerating plant, $30.26; cooking range, $21.47; for paint materials, $208.62; painters (extra skilled labor), $110.23.

With a special view to the removal of obstructions during the usual season of extreme low water, arrangements were made for the temporary employment of the U. S. steamer *Genl. O. M. Poe*, belonging to the Kentucky River improvement, and she was accordingly transferred to the Ohio River district on July 1. The repairs and outfit required before placing the boat in commission were not completed until July 21, and, as the stage of river was too high for work on obstructions, the *Poe* was ordered to join the United States dredges, about 130 miles below Pittsburg, for service as additional tender or to engage in snagging and wrecking, according to conditions. The *Poe* operated in connection with the dredges until August 15, and being no longer needed was then laid up. As the

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conditions for her service on the Ohio River continued unfavorable up to the end of the month, it was considered inadvisable to retain her for a longer period, and she was accordingly ordered to return to her home port at Frankfort, Ky.

In addition to the work reported above, a number of wrecks occurred during the year at various points on the 50 miles of river below Pittsburg, endangering navigation and requiring prompt removal when the snag boat *Woodruff* was too far distant, or, owing to other causes, was not available, and the following obstructions were therefore removed under the direction of S. H. Fowler, inspector, principally by the use of the U. S. launch *Wenonah*, fitted out at Davis Island dam with the necessary explosives, etc.: One coal boat at head of Brunots Island; 1 coal boat at foot of Merriman bar; 1 coal barge, 2 coal boats, and part of another at Whites Ripple; part of a coal boat opposite Haysville, Pa.; 1 coal barge opposite Dam No. 2; 2 coal barges and 1 covered barge above Dam No. 3; a large rock in the channel below Dam No. 3; 1 coal boat opposite Clusters Island, and 3 coal boats opposite foot of Line Island and head of Babbs Island.

In the annual reports of this office for the years 1902, 1903, and 1904 the opinion was expressed that if a light-draft snag-boat service were added to the plant pertaining to the general improvement of the Ohio River it would be of very great utility as a substitute for the *Woodruff* during periods of low water, when such work can be prosecuted most advantageously.

The importance of additional plant adapted to take full advantage of such low stages of river can not be emphasized too strongly, and to this end it is recommended that the yearly appropriation for snagging, as provided by the act of June 3, 1896, be increased to $65,000 for the the fiscal year ending June 30, 1906, the additional $15,000 to be used in the building and equipment of one light-draft combination snag and derrick boat adapted for use at extreme low-water stages. This boat would form a part of the regular snagging plant and would be operated from the yearly appropriation made for that purpose.

List of steamboat wrecks, by name, removed from the Ohio River during the fiscal year ending June 30, 1905, by the U. S. snag boat E. A. Woodruff.

Name.	Location.	Miles below Pittsburg.
Grapevine	Cincinnati, Ohio	469.2
Chickasaw	Jeffersonville, Ind	597
(Unknown)	Evans Landing	636

Summary of expenditures for operating snag boats on the Ohio River for the fiscal year ending June 30, 1905.

Office expenses and superintendence	$2,665.00
Service	18,562.84
Subsistence	3,903.28
Fuel	2,007.51
Explosives, etc	478.34
General supplies and expenses	2,148.29
Care and repair of plant	1,105.49
Expenses of United States dredges, hire of steamboat	3,817.48
Total	34,688.23

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APPENDIX E E.

IMPROVEMENT OF HARBOR AT PITTSBURG, PENNSYLVANIA; OF ALLEGHENY RIVER, PENNSYLVANIA, AND OF MONONGAHELA RIVER, WEST VIRGINIA AND PENNSYLVANIA; CONSTRUCTION OF LOCKS AND MOVABLE DAMS NOS. 2–7, OHIO RIVER; OPERATING AND CARE OF DAMS NOS. 1 AND 6, AND DREDGING POOL 6, OHIO RIVER.

REPORT OF MAJ. WM. L. SIBERT, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1905, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Monongahela River, West Virginia.
2. Monongahela River, Pennsylvania.
3. Operating and care of locks and dams, Monongahela River, West Virginia and Pennsylvania.
4. Harbor at Pittsburg, Pennsylvania.
5. Operating and care of Locks and Dams Nos. 1 and 6, Ohio River.
6. Construction of Locks and Dams Nos. 2–7, Ohio River, Pennsylvania.
7. Dredging Pool 6, Ohio River.
8. Construction of locks and dams above head of Sixmile Island and at Springdale, Allegheny River, Pennsylvania.
9. Operating and care of Locks and Dams Nos. 1 and 3, Allegheny River, Pennsylvania.
10. Allegheny River, Pennsylvania.

SPECIAL REPORT.

11. Allegheny River locks and dams.

HARBOR LINES.

12. Monongahela River, McKeesport, Pennsylvania, to Wilson, Pennsylvania.
13. Monongahela River at Lock No. 2, Port Perry, Pennsylvania.

UNITED STATES ENGINEER OFFICE,
Pittsburg, Pa., July 15, 1905.

GENERAL: I have the honor to forward herewith annual reports of works under my charge for the year ending June 30, 1905.

Very respectfully, your obedient servant,

WM. L. SIBERT,
Major, Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

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E E 1.

IMPROVEMENT OF MONONGAHELA RIVER, WEST VIRGINIA.

Lock and Dam No. 10, above Morgantown.—The filling, grading, and riprapping above upper guide wall on left bank was completed. A wing wall 55 feet long protected by large stone along lower face was built at lower end of left lock wall. A retaining wall 104 feet long was built along county road. Three hundred and eleven square yards of concrete walks, concrete steps from lock wall to lower guide crib, a blacksmith shop, storehouse, and coal house were constructed under contract. One thousand two hundred and seventy-three square yards of brick pavement were laid in lock terreplein. A well 60 feet deep was sunk, and connecting sewer from house No. 1 was built.

Lock and Dam No. 11, below Uffington.—A dwelling, water-closet, blacksmith shop, coal and store houses, 251 square yards of concrete walk, and concrete steps from lock wall to lower guide crib were constructed under contract. Foundation for office building was built. Five hundred and fifty-seven yards of brick pavement were laid in lock terreplein. A well 80 feet deep was sunk. Necessary sewers and drains for dwelling and office were built. Five hundred cubic yards of filling were placed behind upper guide wall. Left bank of river was graded and riprapped for a distance of 140 feet below lock. The right bank was riprapped for 150 feet below retaining wall. Large protection stone was placed along lower face of return wall at lower end of guide wall, and similar protection to wing wall was begun.

Lock and Dam No. 12, below Little Falls.—A dwelling, water-closet, office, blacksmith shop, store and coal houses, 271.5 square yards of concrete walks, and concrete steps from lock wall to lower guide crib were constructed under contract. Four hundred and seventy-two square yards of brick pavement were laid in lock terreplein. A well 63 feet deep was sunk. Necessary sewers and drains for dwelling and office were built. Large protection stone was placed along lower face of return wall at end of lower guide wall and below core of dam on right bank.

Lock and Dam No. 13, above Little Falls.—A dwelling, water-closet, office, blacksmith shop, coal and store houses, 220 square yards of concrete walk, and concrete steps from lock wall to lower guide crib were constructed under contract. One thousand two hundred and thirty-five square yards of brick pavement were laid in lock terreplein. A well 75 feet deep was sunk. Necessary sewers and drains for dwelling and office were built. The left bank of river for a distance of 120 feet below lock was graded and riprapped. Large protection stone was placed along lower face of return wall at end of lower guide wall, and the placing of similar protection along face of lower wing wall of lock was begun.

Lock and Dam No. 14, at Lowsville.—2.69 acres of land were purchased from John Hood and county road moved back of lock grounds. A dwelling, water-closet, blacksmith shop, coal and store houses, 254 square yards of concrete walks, and concrete steps from lock wall to lower guide crib were constructed under contract. Foundation for office building was built. Seven hundred and ninety-seven square yards of brick pavement were laid in lock terreplein. A well 82.7 feet deep was sunk. Necessary sewers and drains for dwelling and

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office were built. The left bank of river for a distance of 335 feet below lock was graded and riprapped. Large protection stone was placed along lower face of core wall and return wall, and the placing of similar protection stone along lower wing wall was begun. Four hundred and fifty cubic yards of filling was done back of upper guide wall. The right bank of river for a distance of 75 feet below retaining wall was partly riprapped.

Lock and Dam No. 15, at Hoult.—A dwelling, water-closet, blacksmith shop, coal and store houses, 203 square yards of concrete walks, and concrete steps from lock wall to lower guide wall were constructed under contract. One thousand one hundred and twenty-four square yards of brick pavement were laid in lock terreplein. A well 73 feet deep was sunk. Necessary sewers and drains for dwelling and office were constructed. The right bank of river for a distance of 125 feet below lock was graded and riprapped. The county road across terreplein was paved.

Money statement.

July 1, 1904, balance unexpended	$107,568.74
Amount received account of failure to complete locks and dams 10–15 under C. I. McDonald contract	107,463.86
	215,032.60
June 30, 1905, amount expended during fiscal year, for works of improvement	89,938.68
July 1, 1905, balance unexpended	125,093.92
July 1, 1905, outstanding liabilities	5,032.52
July 1, 1905, balance available	120,061.40
July 1, 1905, amount covered by uncompleted contracts	1,457.50

APPROPRIATIONS.

June 10, 1872, improving Monongahela River between Morgantown And New Geneva	$25,000.00
March 3, 1873, improving upper Monongahela River near Morgantown, W. Va.	66,000.00
June 23, 1874, improving upper Monongahela River near Morgantown, W. Va	25,000.00
March 3, 1875, improving upper Monongahela river near Morgantown, W. Va	22,000.00
June 18, 1878, improving Monongahela River, West Virginia and Pennsylvania	25,000.00
March 3, 1879, improving Monongahela River, West Virginia and Pennsylvania	24,000.00
June 14, 1880, improving Monongahela River, West Virginia	25,000.00
March 3, 1881, improving Monongahela River, Pennsylvania and West Virginia	25,000.00
August 2, 1882, improving Monongahela River, West Virginia	25,000.00
July 5, 1884, improving Monongahela River, West Virginia	45,000.00
August 5, 1886, improving Monongahela River, Pennsylvania and West Virginia	90,900.00
August 11, 1888, improving Monongahela River, West Virginia	35,000.00
September 25, 1889 (allotment)	4,000.00
July 13, 1892, improving Monongahela River, West Virginia	25,000.00
August 18, 1894, improving Monongahela River, West Virginia and Pennsylvania	20,000.00

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June 3, 1896, improving upper Monongahela River, West Virginia	$30,000.00
June 4, 1897, improving upper Monongahela River, West Virginia	350,000.00
July 1, 1898, improving upper Monongahela River, West Virginia	400,000.00
June 28, 1902, improving Monongahela River, West Virginia	350,000.00
April 28, 1904, improving Monongahela River, West Virginia	100,000.00
Total	1,711,900.00
Received on bond of failing contractor	107,463.86
	1,819,363.86

ABSTRACT OF CONTRACTS IN FORCE.

Building a storehouse, blacksmith shop, and coal house at Lock No. 10, and an office, storehouse, blacksmith shop, and coal house at each of Locks Nos. 12, 13, and 15, Monongahela River.

Contractor: Kammerer & Kern, Morgantown, W. Va.
Rates: Lock No. 10, $1,254; Lock No. 12, $2,056; Lock No. 13, $2,056; Lock No. 15, $2,040.
Date of approval: [a]
Date of beginning work: August 15, 1904.
Date of expiration: October 14, 1904 (extended for a reasonable period).

Building a frame dwelling and privy at each of Locks Nos. 12, 13, 14, and 15, Monongahela River.

Contractor: Kammerer & Kern, Morgantown, W. Va.
Rates: Lock No. 12, $2,673; Lock No. 13, $2,673; Lock No. 14, $2,654; Lock No. 15, $2,642.
Date of approval: September 6, 1904.
Date of beginning work: September 19, 1904.
Date of expiration: December 1, 1904.

Building a frame dwelling and privy at Lock No. 11, Monongahela River.

Contractor: Charles G. Lutes, Morgantown, W. Va.
Rate: $2,650.
Date of approval: September 16, 1904.
Date of beginning work: October 1, 1904.
Date of expiration: December 1, 1904 (extended for a reasonable period).

Building a storehouse, blacksmith shop, and coal house at each of Locks Nos. 11 and 14, Monongahela River.

Contractor: Brady Construction Company, Fairmont, W. Va.
Rates: Lock No. 11, $1,259; Lock No. 14, $1,259.
Date of approval: [a]
Date of beginning work: September 5, 1904.
Date of expiration: November 4, 1904.

Constructing concrete walks, cellar floors and steps at Locks Nos. 10 to 15, Monongahela River.

Contractor: Morgantown Cement Building Block Company, Morgantown, W. Va.
Rates: Concrete walks, $1.60 per square yard; concrete cellar floors, 60 cents per square yard; concrete steps, $8 per cubic yard.
Date of approval: [a]
Date of beginning work: October 3, 1904.
Date of expiration: December 12, 1904.

[a] Emergency.

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COMMERCIAL STATISTICS.

Traffic through United States Locks Nos. 9–15 for the fiscal year 1905, as measured by the commerce through Lock No. 9.

Freight	tons [a]	33,857
Passengers	number	14,371

E E 2.

IMPROVEMENT OF MONONGAHELA RIVER, PENNSYLVANIA.

Rebuilding Lock and Dam No. 2.—At the beginning of the fiscal year the temporary and permanent intake for the water supply of the Carnegie Steel Works was completed. Under their contract The Dravo Contracting Company had practically completed the cofferdam around the lock site. The excavation for the lock foundation was two-thirds completed. The work on abutment and dam to be done by hired labor had just begun.

In July, 1904, The Dravo Contracting Company, under their contract, began driving piles from a floating plant. Four thousand and fifty-two piles were driven in this way by the end of August. It was then decided to start cutting off the piles by a submarine saw placed on a scow. In order that scow could be floated over piles, deeper water was needed in the cofferdam and extension leads were necessarily added to the pile driver. It was found that neither the submarine saw nor extension leads were successful, so that after some delay the driving and cutting off was continued in a dry cofferdam. On October 20 the piles were all driven, sawn off, excavation around head of piles and the placing of stone in longitudinal drains was completed, and the concrete work began. On December 24 work was discontinued for the winter. Work was resumed on April 6. The deposit from winter floods was softened by water and removed by pumps. Concrete work was then resumed and continued until May 13, when a break in the cofferdam delayed this work until the 25th. In spite of these delays good progress was made during the year. The remainder of excavation was completed. The pile and concrete foundation of walls and lock chambers was finished. The middle and river walls and all but 78 feet of the land wall were completed. A crib protection to river wall, 150 feet long, was placed. Eighty-three feet of upper guard wall were built and 150 piles for foundation of upper guide wall and forebay driven.

Work accomplished and material placed:

Earth excavation	cubic yards	8,863
Rock excavation	do	4.4
Round piles driven	number	5,517
Sheet piling	feet B. M.	250,132.8
Caps, flooring, and wales	do	139,483.1
Crib timber placed	do	99,153
Stone ballast	cubic yards	2,127.8
Concrete	do	35,987.3
Iron	pounds	88,547

[a] 2,000 pounds.

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The temporary intake for the supply of the Carnegie Steel Works was extended 185 feet into the river. This work was done by the United States by hired labor, except that the piles, 107 in number, were driven by The Dravo Contracting Company, under contract.

Work accomplished by hired labor.—The abutment wall, 254 feet long, and the core walls extending into the slag bank about 12 feet, were completed. One hundred feet of crib protection was sunk along face of abutment wall below dam. A 390-foot section of the dam foundation and 21 feet of the concrete superstructure of the same were finished. In constructing the dam the excavation was first made for both dam and apron crib, the bearing piles driven and the upstream sheet piling driven and earth banked along its upstream face and along the downstream face of the apron crib. A bulkhead was then built across the outer end of this structure and earth banked up around it, forming a cofferdam for the concrete work.

Total work accomplished and materials placed by the United States:

Earth dredging	cubic yards	25,625
Slag excavation	do	1,221
Round piles	number	851
Sheet piling	feet B. M.	125,738
Crib timber, wales, etc	do	246,172
Broken stone	cubic yards	4,810
Gravel filling	do	626
Concrete	do	2,632.1

Assistant Engineer Thomas P. Roberts is in general charge of this work, and Assistant Engineer John B. Dimmick is in local charge.

Rebuilding Lock and Dam No. 3.—The necessary land on the lock side of river has been purchased and the right of way for abutment secured. The contract for the costruction of the lock has been let to The Dravo Contracting Company. No work has yet been done by the contractor. It is intended to construct the abutment and dam by hired labor. Preparatory surveys have been made and plant is being assembled and temporary buildings erected.

Assistant Engineer Oscar Shanks is in charge of this work.

Locks 3, 6, etc.—Three pieces of land were secured by condemnation during the year at a cost of $3,100. Authority has been received for securing some additional land, either by purchase or condemnation, needed at Lock 6.

Locks 5 and 6.—The act of March 3, 1905, provided for the acquisition of necessary land and construction of certain improvements at Locks and Dams 5 and 6, at an estimated cost of $7,850. The purchase of river front at Lock and Dam No. 6 has been authorized and negotiations are under way for securing the property. No work on the other improvement provided for by this appropriation was done during the year.

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Money statements.

CONSOLIDATED.

July 1, 1904, balance unexpended	$601,334.23
Amount appropriated by river and harbor act approved March 3, 1905	207,850.00
	809,184.23
June 30, 1905, amount expended during fiscal year, for works of improvement	320,078.64
July 1, 1905, balance unexpended	489,105.59
July 1, 1905, outstanding liabilities	50,314.07
July 1, 1905, balance available	438,791.52
July 1, 1905, amount covered by uncompleted contracts	437,691.58
Amount (estimated) required for completion of existing project	389,196.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	389,196.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

REBUILDING LOCK NO. 2.

July 1, 1904, balance unexpended	$594,417.85
June 30, 1905, amount expended during fiscal year, for works of improvement	306,667.15
July 1, 1905, balance unexpended	287,750.70
July 1, 1905, outstanding liabilities	25,700.62
July 1, 1905, balance available	262,050.08
July 1, 1905, amount covered by uncompleted contracts	181,131.58

REBUILDING LOCK NO. 3.

Amount appropriated by river and harbor act approved March 3, 1905	$200,000.00
June 30, 1905, amount expended during fiscal year, for works of improvement	10,299.14
July 1, 1905, balance unexpended	189,700.86
July 1, 1905, outstanding liabilities	21,113.45
July 1, 1905, balance available	168,587.41
July 1, 1905, amount covered by uncompleted contracts	256,560.00
Amount (estimated) required for completion of existing project	389,196.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	389,196.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

LOCKS 3, 6, ETC.

July 1, 1904, balance unexpended	$6,916.38
June 30, 1905, amount expended during fiscal year, for works of improvement	3,112.35
July 1, 1905, balance unexpended	3,804.03
July 1, 1905, outstanding liabilities	3,500.00
July 1, 1905, balance available	304.03

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LOCKS 5 AND 6.

Amount appropriated by river and harbor act approved March 3, 1905	$7,850.00
July 1, 1905, balance unexpended	7,850.00

APPROPRIATIONS.

August 11, 1888, costs of condemnation, Lock and Dam No. 7, Monongahela River, Pennsylvania	[a] $5,000.00
September 19, 1890, costs of condemnation, Lock and Dam No. 6, Monongahela River, Pennsylvania	[b] 5,000.00
August 11, 1888, purchase of upper Lock and Dam No. 7, Monongahela River	[c] 161,733.13
September 19, 1890, purchase of upper Lock and Dam No. 6, Monongahela River	[b] 162,000.00
June 3, 1896, costs of condemnation, property of Monongahela Navigation Company	[d] 5,000.00
June 3, 1896, award for property of Monongahela Navigation Company	3,761,615.46
March 3, 1899, improving Locks 3 and 6, and for floating plant	50,000.00
June 6, 1900, completing improvement at Locks 3 and 6, and for floating plant	135,556.00
June 13, 1902, rebuilding Lock and Dam 2	200,000.00
March 3, 1903, rebuilding Lock and Dam 2	455,961.00
March 3, 1905, certain improvements at Lock and Dam 5 and 6	7,850.00
March 3, 1905, rebuilding Lock and Dam 3	200,000.00
Total	5,149,715.59
Amount carried to surplus fund	331,274.71
	4,818,440.88

ABSTRACT OF CONTRACTS IN FORCE.

Building a lock with two chambers, two guide walls, and a guard wall, below Turtle Creek, opposite the Edgar Thomson Furnaces, Monongahela River.

Contractor: The Dravo Contracting Company, Pittsburg, Pa.

Rates: Earth excavation, 60 cents per cubic yard; hardpan excavation, 75 cents per cubic yard; rock excavation, $1 per cubic yard; piles, $6 each; piles, sheet, $55 per M. feet B. M.; caps, flooring, and wales (oak), $54 per M. feet B. M.; grillage (hemlock), $41.50 per M. feet B. M.; crib timber (hemlock), $43 per M. feet B. M.; stone ballast, $2.50 per cubic yard; concrete (lock, guide, and guard walls), $5.50 per cubic yard; concrete (floor of lock), $5.50 per cubic yard; I beams (steel), 4 cents per pound; iron for bolts, shoes, etc., 4 cents per pound.

Date of approval: May 16, 1904.

Date of beginning work: June 7, 1904.

Date of expiration: June 30, 1905 (extended for a reasonable period).

Furnishing and delivering iron, steel, and bronze work for new Lock No. 2, Monongahela River.

Contractor: Sterrit-Thomas Foundry Company, Pittsburg, Pa.

Rates: Cast ironwork, $0.0295 per pound; wrought ironwork, $0.05 per pound; cast steel, $0.065 per pound; structural steel work—valves, $0.0425 per pound; forged steel shafts, $0.0575 per pound; phosphor-bronze work, $0.40 per pound.

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[a] Partly applied; $98.64 to surplus fund.
[b] To surplus fund.
[c] Partly applied; $161,333.13 to surplus fund.
[d] Partly applied; $2,842.94 to surplus fund.

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Date of approval: [a]
Date of beginning work: September 16, 1904.
Date of expiration: September 30, 1904.

Building and erecting in place four pairs of lock gates and anchorages, Lock No. 2, Monongahela River.

Contractor: American Bridge Company of New York, New York, N. Y.
Rates: Nickel steel, 7½ cents per pound; iron and steel castings, 7 cents per pound; bronze, 30 cents per pound; white oak, $80 per M. feet B. M.
Date of approval: November 2, 1904.
Date of beginning work: November 15, 1904.
Date of expiration: August 31, 1905.

Furnishing and delivering at Carnegie Siding, Bessemer Station, Pittsburg and Lake Erie Railroad (new Lock No. 2, Monongahela River), four windlass and two capstan engines.

Contractor: James Rees & Sons Company, Pittsburg, Pa.
Rates: $6,340 for the six engines.
Date of approval: [a]
Date of beginning work: April 27, 1905.
Date of expiration: June 5, 1905.

Building a lock with two chambers, two guide walls, and a guard wall, near Elizabeth, Pa., on the Monongahela River.

Contractor: The Dravo Contracting Company, Pittsburg, Pa.
Rates: Earth excavation, 50 cents per cubic yard; rock excavation, $2 per cubic yard; back fill, 30 cents per cubic yard; concrete, $5.25 per cubic yard; reenforcing concrete, $7 per cubic yard.
Date of approval: June 28, 1905.
Date of beginning work: July 20, 1905.
Date of expiration: August 1, 1906.

COMMERCIAL STATISTICS.

Commercial statistics for Monongahela River, Pennsylvania, are attached to report for operating and care of locks and dams, Monongahela River, West Virginia and Pennsylvania.

E E 3.

OPERATING AND CARE OF LOCKS AND DAMS, MONONGAHELA RIVER, WEST VIRGINIA AND PENNSYLVANIA.

A detailed description of the operation of these locks during the fiscal year ending June 30, 1905, will be found in the attached reports of Assistant Engineers Thomas P. Roberts and J. L. Callard.

[a] Emergency.

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ALLOTMENT OF FUNDS.

August 15, 1884	$1,000.00	July 23, 1894	$25,664.00
September 1, 1884	4,000.00	July 12, 1895	20,372.40
November 3, 1884	4,500.00	July 28, 1896	19,232.84
December 20, 1884	500.00	July 15, 1897	[a] 13,070.87
June 1, 1885	100.00	August 2, 1897	[b] 119,734.49
July 22, 1885	1,000.00	October 8, 1897	125.00
July 10, 1886	1,200.00	September 1, 1898	[c] 197,627.93
March 1, 1887	1,100.00	August 14, 1899	169,838.00
July 1, 1887	11,000.00	September 7, 1900	175,474.96
July 11, 1888	6,270.00	August 5, 1901	159,266.46
October 27, 1888	3,000.00	July 26, 1902	237,963.86
July 17, 1889	1,480.00	August 4, 1903	200,949.31
October 7, 1889	1,500.00	August 10, 1903	21,050.00
November 6, 1889	1,200.00	November 18, 1903	[d] 21,500.00
July 24, 1890	12,300.00	July 22, 1904	[e] 255,381.10
July 8, 1891	24,250.00		
July 21, 1892	34,017.86	Total	1,769,243.80
July 21, 1893	23,574.72		

ABSTRACT OF CONTRACT IN FORCE.

Building and delivering on barges or flats at Pittsburg, Pa., a steel lock gate and anchorage.

Contractor: Lawrence D. Weaning, Cleveland, Ohio.

Rates: Nickel steel, 6¼ cents per pound; iron and steel castings, 5 cents per pound; bronze, 25 cents per pound; white oak, $85 per M feet B. M.

Date of approval: [f]

Date of beginning work: October 21, 1904.

Date of expiration: June 1, 1905.

Classified statement of expenditures for operating and care of Monongahela River Locks and Dams Nos. 1 to 15, inclusive, during the fiscal year ending June 30, 1905.

Item.	Amount.
Salaries and wages of regular hired labor force	$159,790.70
Miscellaneous supplies and services	8,947.06
Dam, lock, boat, and boat-yard supplies, and repair material not otherwise provided for	28,901.27
Repairs to repair plant and additional pieces of same	5,849.89
Rebuilding, repairs not otherwise provided for, dredging, and removing of obstructions	36,781.49
Total	234,070.41

[a] Locks 8 and 9.
[b] Locks 1 to 7 inclusive.
[c] Locks 1 to 9 inclusive.
[d] Locks 10 to 15.
[e] Locks 1 to 15.
[f] Emergency.

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COMMERCIAL STATISTICS.

Lockages made and traffic passed at Monongahela River locks during year ending June 30, 1905.

At dams—	Lockages.		Steamboats.		Coal boats, barges, flats, and boat bottoms.		Rafts.	
	Up.	Down.	Up.	Down.	Up.	Down.	Up.	Down.
	Number.	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*No.*	*No.*
1	8,838	8,682	6,192	6,204	14,336	14,752	166	8
2	9,424	9,108	5,604	5,606	18,232	18,640	143	13
3	8,342	8,255	4,582	4,537	18,313	18,921	16	61
4	7,402	7,195	4,130	4,133	16,561	16,675	4	49
5	2,648	2,905	1,943	1,942	2,705	2,708	3	53
6	1,290	1,344	884	882	999	1,005	6	49
7	569	613	495	495	213	204	1	42
8	664	705	542	541	221	229	13	48
9	535	561	477	479	229	222	1	27
10	432	445	355	355	151	149	2	26
11	440	452	306	306	142	137	2	32
12	337	352	294	295	105	105	.....	21
13	380	397	276	275	84	82	1	23
14	438	436	383	380	49	51	4	20
15	617	622	559	560	54	66	.....	2
Aggregate	42,306	42,012	26,972	26,987	72,894	73,946	362	464

At dams—	Other craft.		Coal.		Coke.		Rails, steel.	
	Up.	Down.	Up.	Down.	Up.	Down.	Up.	Down.
	Number.	*Number.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
1	985	929	16,100	4,160,000	.....	3,975	76	1,208
2	356	372	22,968	6,955,104	.....	.....	96	.....
3	233	216	1,280	7,182,980	.....	.....	49	75
4	175	167	844	6,277,020	.....	.....	73	2
5	83	74	320	726,228	.....	.....	38	.....
6	50	38	288	318,840	.....	.....	45	.....
7	36	31	140	5,420	.....	.....	16	.....
8	97	85	48	5,428	.....	.....	1	.....
9	48	43	.....	5,432	.....	.....	2	.....
10	112	107	.....	3,452	.....	.....	.....	.....
11	130	130	.....	3,452	.....	.....	.....	.....
12	52	53	72	2,220	.....	.....	.....	.....
13	70	66	.....	2,220	.....	.....	.....	.....
14	60	55	.....	.....	.....	.....	.....	.....
15	80	77	.....	.....	.....	.....	.....	.....
Aggregate	2,517	2,443	42,060	25,647,846	.....	3,975	396	1,281

At dams—	Other iron products.		Sand.		Gravel.	
	Up.	Down.	Up.	Down.	Up.	Down.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
1	3,144	39,792	398,345	48,690	580,759	38,806
2	3,659	15,481	98,745	98,484	227,784	5,496
3	3,331	14,611	8,069	208,517	76,287	4,076
4	2,465	256	54,339	482	54,811	2,139
5	1,827	196	172	.....	52,021	1,241
6	1,531	40	.....	84	379	172
7	1,022	199	.....	.....	276	.....
8	698	206	.....	193	276	.....
9	379	149	3,334	21	276	.....
10	15	144	650	21	276	.....
11	38	189	590	21	228	.....
12	38	140	530	21	166	.....
13	22	96	244	.....	138	.....
14	30	69	196	.....	103	.....
15	.....	3	.....	.....	.....	.....
Aggregate	18,199	71,523	560,214	341,484	993,280	51,930

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Lockages made and traffic passed at Monongahela River locks during year ending June 30, 1905—Continued.

At dams—	Stone.		Brick.		Timber.	
	Up.	Down.	Up.	Down.	Up.	Down.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
1	3,429	1,995	13	222	29,214	691
2	618	7,069	3	135	22,322	1,103
3	.....	6,795	3	210	2,476	9,398
4	.....	6,444	6	120	675	7,343
5	159	9,400	52	.....	531	9,900
6	59	5,446	8	.....	188	9,023
7	.....	5,787	5	.....	36	5,644
8	1,124	1,088	.....	3	185	5,095
9	1,428	5	4	154	42	3,713
10	1,319	895	89	78	23	3,315
11	684	857	753	800	16	3,251
12	1,362	124	562	228	6	2,497
13	1,092	47	191	229	5	2,204
14	459	18	159	228	29	1,631
15	82	247	.....	245	.....	220
Aggregate	11,315	46,162	1,848	2,152	55,748	65,068

At dams—	Lumber.		Lath.		Posts.	
	Up.	Down.	Up.	Down.	Up.	Down.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
1	24,178	1,115	117	.....	12,219	.....
2	13,857	1,823	92	2	14,396	.....
3	6,743	1,377	56	.....	11,427	325
4	1,161	1,329	6	.....	7,485	828
5	567	2,955	1	1	.....	10,869
6	198	3,368	.....	1	18	9,660
7	113	2,842	.....	.....	.....	10,447
8	37	3,272	.....	6	.....	10,843
9	8	2,745	.....	2	.....	10,571
10	89	709	.....	.....	.....	1,876
11	75	600	.....	3	.....	2,300
12	41	350	.....	3	.....	.....
13	190	243	.....	8	2	.....
14	142	292	.....	8	.....	.....
15	51	326	.....	9	.....	.....
Aggregate	47,450	23,346	272	43	45,517	57,719

At dams—	Braces.		Ties, railroad.		Wood.		General merchandise.	
	Up.	Down.	Up.	Down.	Up.	Down.	Up.	Down.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
1	1,732	.....	3,050	45	30	80	10,805	13,054
2	1,440	.....	6,510	45	30	121	9,643	6,452
3	1,720	.....	3,300	25	30	120	9,341	2,181
4	.....	.....	960	25	30	121	8,871	2,490
5	.....	.....	.....	1,525	30	121	8,786	2,294
6	.....	.....	.....	2,565	60	121	6,633	1,948
7	.....	1	.....	2,665	30	110	4,025	1,192
8	.....	.....	.....	4,095	.....	112	2,964	855
9	.....	2	.....	2,170	.....	15	2,244	818
10	.....	.....	.....	2,255	.....	.....	540	220
11	.....	.....	.....	1,735	.....	.....	555	257
12	.....	.....	.....	355	.....	5	451	247
13	.....	.....	.....	25	.....	.....	394	271
14	.....	.....	.....	.....	.....	.....	306	258
15	.....	.....	.....	.....	.....	.....	161	379
Aggregate	4,892	3	13,820	17,530	240	926	65,689	32,916

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Lockages made and traffic passed at Monongahela River locks during year ending June 30, 1905—Continued.

At dams—	Farm, dairy, and orchard products.		Live stock, large.		Live stock, small.		Passengers.	
	Up.	Down.	Up.	Down.	Up.	Down.	Up.	Down.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*No.*	*No.*
1	1,372	98	319	289	2	89	39,558	38,900
2	1,383	130	360	334	2	88	31,396	30,334
3	1,114	171	257	325	4	89	19,705	19,117
4	1,079	198	287	283	2	89	13,216	12,808
5	732	189	145	190	1	153	24,151	21,542
6	479	105	121	180	2	163	10,422	9,280
7	266	36	74	96	.....	.....	8,317	7,717
8	218	18	64	64	.....	.....	7,875	7,626
9	147	22	59	65	.....	.....	7,408	6,963
10	1	5	4	3	.....	.....	4,077	3,894
11	1	2	4	4	.....	.....	4,120	3,792
12	1	5	3	2	.....	.....	3,694	3,456
13	1	3	4	3	.....	.....	4,239	3,880
14	.....	3	4	4	.....	.....	4,971	4,434
15	.....	3	4	3	.....	.....	11,476	10,615
Aggregate	6,794	988	1,809	1,845	13	671	194,625	184,333

Total commerce of the river.

Fiscal year.	Products.	Passengers.
	Tons.[a]	
1902	9,100,887	181,527
1903	11,369,814	101,457
1904	9,268,736	116,174
1905	9,211,752	78,458

[a] 2,000 pounds.

The total commerce of the Monongahela River is obtained by summing up the maximum tonnage of the several kinds of freight passing any single dam. The coal item in this total is that passed down through Lock No. 3, plus that mined in the first and second pools.

REPORT OF MR. THOMAS P. ROBERTS, ASSISTANT ENGINEER.

The fall months were unusually dry. During September, October, and November only 2.47 inches rain fell at Lock No. 4, and it was only by drawing upon spare water in the upper pools that the coal traffic below Lock No. 5, excepting in boats of shallow draft, was maintained for a number of days in November and early part of December.

Lock and Dam No. 1, Pittsburg.—Fifty-three linear feet of the upper slope was rebuilt. The lower slope of the dam, 962 feet long, was repaired where needed. Seventeen thousand feet B. M. oak timber and 600 cubic yards stone were used in this work. A frame office and engine building, 16 by 32 feet, was built on the middle wall between the two lock chambers. A new double cylinder engine, 9 by 12 inches, was installed for operating capstans and spars.

Lock and Dam No. 2, Port Perry.—During August 200 linear feet of upper slope of dam was renewed; old timber abutment temporarily repaired. Owing to the action of acids in the river water, a number of the filling valves had to be taken out and new three-fourth-inch steel blades inserted in them. Fifty-one new tubes were required in one of the boilers for the same reason. About 1,000 feet B. M. oak were used in repair of lock gates. Eighty-three piles, sheeted with 6-inch oak, were driven on shore line above the lock to replace old guide crib which fell down in June, 1904.

Lock and Dam No. 3, above Elizabeth.—The locks were alternately closed for a number of days in August and September to permit the repairs to valves in the gates, stopping of leaks beneath the timber floors of the lock chamber, and

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the repairing of heel and toe parts of gates damaged by vessels. About 850 feet B. M. oak were used in gate repairs. In November, on account of low water, the small lock was closed and its valves choked with straw, etc., to save water, the pool having declined to several inches below the elevation of the crest of the dam. In June the old decayed gates at the upper end of the small lock were taken out and new gates erected in their place.

Lock and Dam No. 4, below Charleroi.—In last annual report an account of the damage to the small lock by the steamer *Edgar Cherry* was given. July 12 the lock was pumped out and work started in taking out the débris of the damaged floor timbers. It was concluded best to drive piles over the entire chamber area between the upper quoins and the lower gate recess, 155 by 50 feet, which work was done after about 5 feet of the sand and gravel had been excavated in the bottom. The piles, spaced about 4 feet apart, were cut off about a foot below floor line and filled over with concrete in monolithic sections across the chamber. Depth of concrete about the piles, 4½ feet. This floor thus made will become a part of the enlarged lock, which it is expected will be constructed within a few years. The river wall of the damaged lock was thoroughly grouted, new gate sills placed at upper end, and three new gates put in place and the lock finally opened to navigation November 20.

The old masonry abutment of the dam was torn down and the material used to form part of the bank protection below the new concrete abutment. About 10,000 cubic yards of material dredged from the river were deposited on the river bank below the abutment before the stone pavement was laid.

Lock and Dam No. 5, above Brownsville.—An examination of the filling valves in the floor above the upper gates in May disclosed the fact that they were beyond further repair and six new valves were ordered and were about ready for delivery at the end of the fiscal year. Only ordinary repairs were elsewhere needed. In August 2,000 bushels of ashes were scattered along the dam above the flash boards in order to prevent the loss of the reserve water.

Lock and Dam No. 6, Rices Landing.—An apron crib 200 feet long, 8 feet high, and 18 inches wide was built and filled with stone below the dam next the lock wall. This portion of the dam, which rests on solid rock, appears to be peculiarly liable to be damaged by the reaction of ice in the spring break-ups. The lock grounds were enlarged by the purchase of additional property.

Lock and Dam No. 7, below Greensboro.—A two-story frame building 12 by 36 feet was constructed by hired labor. The interior of lock master's dwelling was papered. A lock gate disabled because of a broken suspension bar was repaired. In June work was commenced on the construction of an apron crib below the dam near mid-river to protect the dam from the action of ice. Minor repairs were made to the abutment of the dam and bank protection below it.

Lock and Dam No. 8, mouth of Dunkard Creek.—Three hundred and fourteen square yards of the terreplein pavement were taken up and relaid. The terrace slope was graded and seeded, a second set of terrace slope steps was added, and 168½ square yards of cement walk connecting the dwellings and office laid. A portion of the upper guide crib damaged by ice required new sheeting.

Lock and Dam No. 9, Hoard, W. Va.—The sanitary conditions were improved by draining the low ground in the rear of the dwellings and filling over the drainpipes. In this work 622 cubic yards of sandy loam from the river bank were used.

Boat yard and shop, Lock No. 4.—A second launchway, 125 feet, was graded at upper end of yard and its river face protected with timber and sheeting; 13,500 feet B. M. material were used in its construction. During the year the following boats were built and launched: One pile-driver boat; 1 derrick boat; 6 lock-service flats, 11 by 39 feet; 1 lock-service flat, 11 by 49.6 feet; 2 flats for stone, 18 by 90 feet; 4 flats for stone, 20 by 100 feet; 2 flats for concrete mixers, 24 by 100 feet. One new lock gate for small Lock No. 4 and two gates for Lock No. 3 were completed and launched. One planing machine, 1 circular ripsaw, 1 band saw, and 1 automatic knife grinder were purchased and placed in the planing mill. The superintendent's dwelling was moved from the boat yard to a neighboring lot, which was purchased for the purpose. Considerable repairs were made to plastering, flooring, and porches of the dwelling. A well was drilled at the dwelling, striking good water at a depth of 112 feet. The sawmill furnished nearly all the material for the new boats, besides hemlock plank for flashboards. The machine shop and forge turned out irons for the boats, besides doing much miscellaneous work in repairs to lock machinery and in repairs to dredge and other boats in the service.

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Snagging, etc.—There were removed from the channel in the various pools the following by the snagging steamer *General Theodore Schwan:* Pool 1, 2 wrecks, 2 snags; pool 2, 1 wreck, 2 snags; pool 4, 1 wreck, 2 snags; pool 5, 2 snags; pool 6, 4 snags; pool 7, 10 snags; pool 9, 16 snags; pool 10, 1 wreck, 2 snags; pool 11, 14 snags; pool 12, 6 snags; pool 13, 15 snags.

Harbor lines, Monongahela River, above Elizabeth.—The extension of harbor lines up the Monongahela River from Elizabeth having been authorized, a survey based on an accurate triangulation system was made from Elizabeth to Brownsville, 34 miles. The part from Elizabeth to Lock No. 4, 19 miles, was mapped on 19 sheets, harbor lines were laid down on the sheets, and a public hearing for consideration of the proposed lines was held March 27, 1905. Coordinates of the lines, Elizabeth to Lock No. 4, were computed, a second set of tracings and a title sheet were made, and the maps were forwarded to Washington, with report, on May 31, 1905.

Of the part above Lock No. 4 maps are completed to above Wood run, 9 miles from Lock No. 4, requiring 9 sheets, and some preliminary locations of harbor lines have been made on these sheets.

The further extension of the harbor lines to Lock No. 6, 14 miles above Brownsville, being authorized, preparations were made to extend the survey to that point, and the field work will be started at Brownsville early in July.

REPORT OF MR. J. L. CALLARD, ASSISTANT ENGINEER.

Lock and Dam No. 10, above Morgantown.—The highest flood during the fiscal year occurred on March 10, when the lock walls were covered to a depth of 4.1 feet and were submerged for thirty-five hours. The following-described damage was done by this flood: About 100 square yards of stone paving and 275 cubic yards of spalls and earth were washed out at lower end of lock terreplein. Left bank of river below lock was washed for a distance of 200 feet. The crest of a 30-foot section of dam which was constructed during freezing weather was damaged.

A steel plate covering the valve-operating gear was furnished to replace the one lost in 1901.

Lock and Dam No. 11, below Uffington.—The highest flood during the fiscal year occurred on March 10, when the lock walls were covered to depth of 3.5 feet and were submerged for thirty-eight hours. The following-described damage was done by this flood: The steel plate covering valve-operating gear on right lock wall was displaced and washed away. Slight damage was done to stone paving of lock terreplein. About 25 cubic yards of earth were washed out below lower wing wall. Left bank of river below lock was badly washed for a distance of several hundred feet. The protection to right bank of river below core wall of dam, consisting of 120 linear feet of stone paving and about 250 linear feet of riprap, was washed away, except about 40 linear feet of paving next below core wall; several hundred cubic yards of the bank were also washed away.

Lock and Dam No. 12, below Little Falls.—The highest flood during the fiscal year occurred on March 10, when the lock walls were covered to a depth of 4.5 feet and were submerged for forty hours. The following-described damage was done by this flood: The two steel plates covering valve-operating gear on lock walls were displaced and washed away. Slight damage was done to left bank of river below the lock, and a few of the large stones below core wall of dam were displaced.

Lock and Dam No. 13, above Little Falls.—The highest flood during the fiscal year occurred on March 10, when the lock walls were covered to a depth of 4.2 feet and were submerged for forty-two hours. The following-described damage was done by this flood: The steel plate covering valve-operating gear on right lock wall was displaced and washed away. Left bank of river was badly washed for several hundred feet below lock. About 110 square yards of stone paving covering terreplein and slope back of lower guide wall were displaced, and some 250 cubic yards of spalls and earth were washed away. The surface of right bank of river sloughed off at points distant from 300 to 400 feet below abutment end of dam, carrying with it the riprap protection. This also happened last year. This sloughing of bank is largely due to a lack of proper drainage of roadbed by Baltimore and Ohio Railroad Company. At times of heavy rains, water is allowed to stand and percolate through the bank instead of being carried off by proper drainage.

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One of the wire ropes used for operating the gates broke and was replaced with a new one.

Lock and Dam No. 14, at Louisville.—The highest flood during the fiscal year occurred on March 10, when the lock walls were covered to a depth of 4 feet and were submerged for forty-one hours. The following-described damage was done by this flood: The steel plate covering valve-operating gear on right lock wall was displaced and washed away. Right bank of river was badly washed for several hundred feet below lock. Slight damage was done to stone paving of lock terreplein. The riprap protection to right bank of river below dam was considerably displaced, but none was washed away. On March 29 about 75 linear feet of right bank of river next downstream from lower end of concrete retaining wall slipped.

Lock and Dam No. 15, at Hoult.—The highest flood during the fiscal year occurred on March 10, when the lock walls were covered to a depth of 5.5 feet and were submerged for forty-four hours. Slight damage was done to paved slope back of lower guide wall by this flood.

Worm gearing was substituted for levers for operating the filling valves. Two of the wire ropes used for operating the lock gates were broken and were replaced with new ones.

Monthly lockages of vessels at different dams.

Dam.	1903.						1904.						Total.
	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	
1	1,407	1,314	1,171	1,166	1,135	1,182	1,390	828	1,522	2,196	2,197	2,012	17,520
2	1,526	1,265	1,217	1,379	1,401	1,342	1,439	915	1,685	2,260	2,148	2,005	18,532
3	1,144	1,144	1,829	1,355	1,287	1,083	1,266	806	1,493	1,832	1,737	1,621	16,597
4	978	1,014	1,095	1,240	1,276	951	1,157	732	1,397	1,624	1,588	1,547	14,597
5	605	646	632	638	626	575	276	132	273	422	462	466	5,553
6	324	361	349	320	344	156	62	.....	97	192	222	207	2,634
7	141	141	153	123	106	60	44	.....	54	115	116	129	1,182
8	161	179	162	141	124	48	42	.....	62	130	149	162	1,360
9	138	135	137	115	102	45	27	.....	57	118	119	103	1,096
10	142	137	125	98	58	10	5	.....	22	75	106	99	877
11	147	150	162	103	60	12	5	.....	25	63	93	72	892
12	104	107	103	90	55	8	9	.....	16	58	75	64	689
13	113	108	95	87	46	10	6	.....	15	55	71	61	667
14	146	175	142	98	51	6	5	.....	17	49	72	113	874
15	263	323	216	96	43	1	2	.....	2	38	78	177	1,239
Total	7,339	7,199	7,588	7,049	6,714	5,289	5,735	3,413	6,687	9,236	9,231	8,898	84,318

The locks were temporarily closed to navigation for times and reasons as follows:

Locks.	Repairs.	Floods.	Ice.	Total time.	Number of times.
	d. h. m.	d. h. m.	d. h. m.	d. h. m.	
No. 1:					
Large	0 0 0	6 3 20	0 0 0	6 3 20	2
Small	0 0 0	6 3 20	0 0 0	6 3 20	2
No. 2:					
Large	0 0 0	6 14 5	4 0 0	10 14 5	4
Small	4 19 0	6 14 5	4 0 0	15 9 5	6
No. 3:					
Large	34 0 0	6 4 0	14 0 0	54 4 0	6
Small	39 6 30	6 4 0	14 0 0	59 10 30	7
No. 4:					
Large	0 0 0	5 3 0	8 0 0	13 3 0	4
Small	a 143 0 0	5 3 0	8 0 0	156 3 0	5
No. 5	0 17 0	5 2 0	12 0 0	17 19 0	7
No. 6	0 0 0	2 4 0	33 0 0	35 4 0	5
No. 7	1 16 0	5 2 0	54 0 0	60 18 0	7
No. 8	0 0 0	2 11 0	56 0 0	58 11 0	5
No. 9	0 0 0	5 2 0	56 0 0	61 2 0	6
No. 10	0 3 0	3 13 0	57 0 0	60 16 0	8
No. 11	0 1 0	2 21 0	58 0 0	60 22 0	6
No. 12	0 0 0	5 13 40	55 0 0	60 13 40	6
No. 13	0 0 0	3 22 55	56 0 0	59 22 55	6
No. 14	0 0 0	3 18 0	54 5 0	57 23 0	6
No. 15	0 0 0	4 23 0	57 0 0	61 23 0	6

a Extraordinary repairs caused by accident. See last annual report.

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Dredging during fiscal year 1905.

Date.	Pool.	Location.	General description of work.	Cubic yards.
1904.				
September	2	Lower approach to Lock No. 3	Coal waste, sand, etc	11,000
October	1	Lower approach to Lock No. 2	Gravel and mud	3,300
November	2	Upper approach to Lock No. 2	do	700
Do	1	Turtle Creek bar	Gravel, coal waste, etc	1,800
1905.				
June	1	do	do	7,200
		Total		24,000

The first four items of work were done by the United States dredge and the remaining item by a dredge leased by the United States. The United States dredge was employed several days in removing cofferdams at Lock No. 4 and moving material at new abutment of Dam No. 4, not included in above. It was employed for longer periods at new Dam No. 2, Monongahela River, and at several dams on the Ohio River.

E E 4.

IMPROVEMENT OF HARBOR AT PITTSBURG, PENNSYLVANIA.

A detailed description of the work done during the fiscal year ending June 30, 1905, will be found in the attached report of Assistant Engineer H. C. Gould.

Money statement.

July 1, 1904, balance unexpended		$8,029.92
Amount appropriated by river and harbor act approved March 3, 1905		10,000.00
		18,029.92
June 30, 1905, amount expended during fiscal year, for maintenance of improvement		9,703.99
July 1, 1905, balance unexpended		8,325.93
July 1, 1905, outstanding liabilities		729.65
July 1, 1905, balance available		7,596.28
Amount that can be profitably expended for maintenance of improvement in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905		10,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

APPROPRIATIONS.

March 3, 1899	$110,662.90
June 13, 1902	10,000.00
June 13, 1902 (allotment)	5,000.00
March 3, 1905	10,000.00
Total	135,662.90

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COMMERCIAL STATISTICS.

Classified statement of river traffic in Pittsburg Harbor for calendar year 1904.

Commodities.	Tons.[a]	Commodities.	Tons.[a]
Barges	9,000	Pig iron	780
Braces	240	Poles, brace	2,000
Bark	180	Posts, pit and check	9,330
Bottoms, coal-boat, new	12,528	Sand	843,965
Bricks	361	Steel rails	1,639
Coal	7,010,576	Steel and iron products, miscellaneous	62,653
Coke	6,500	Stone	15,044
Farm, dairy, and orchard products	13,103	Ties, railroad	1,645
General merchandise	59,722	Timber	110,755
Gravel	1,139,921	Wood	304
Lath and shingles	404		
Lumber	32,801	Total	9,373,448
Live stock, large	3,968		
Live stock, small	614		
Manure	4,800	Passengers.....number	604,477
Miscellaneous	30,616		

[a] 2,000 pounds.

NOTE.—In preparing this statement care was taken not to duplicate any items. It should be stated that at least eight-tenths of this commerce is stored in the harbor from a week to several months and then rehandled and shipped out and the empties returned. The rehandling and return of empties are not considered in the table.

REPORT OF MR. H. C. GOULD, ASSISTANT ENGINEER.

Channel dredging.—Channel depths were well maintained during the year, and the only dredging necessary was the removal by the Government dredge *No. 1* of the deposits at mouth of a large sewer on right bank of Monongahela River at the "Panhandle" Railroad bridge.

Removal of abandoned structures, projecting fills, etc.—The removal of a projecting slag-filled point on the Monongahela River, near Hazelwood, was completed in September, 1904, by the Jones & Laughlin Steel Company, in accordance with their agreement made in 1902, and a permit dated August 22, 1904, authorizing change of bank slope.

Marking harbor lines, inspection, and patrol.—The harbor-line marks were renewed at many places where disturbed by floods and by construction near the lines. Additional marks were placed at many points where new bridge piers or new masonry walls, etc., afforded good opportunity for permanent marks.

Patrol of the rivers and banks throughout the harbor was maintained, preventing and stopping violations of the laws in many cases. Inspection of permit works and of other construction near the banks, and supervision of the work of sand dredgers were continued.

The patrol and survey steamboat *Loma* was in commission all the year, only a few small repairs being required.

The naphtha launch *Luzon* was in use all the year. From July 6 to December 10, 1904, this boat was engaged on survey work on Monongahela River above the limits of the harbor.

Changes of harbor lines.—After examination and recommendation by this office a change of harbor line at Lock No. 2, on right bank Monongahela River, was approved February 10, 1905, to take effect when the construction of new Lock No. 2 renders present site of Lock No. 2 useless to the United States.

Miscellaneous.—Public hearings were held as follows: September 8, 1904, proposed changes of harbor lines in back channel at Brunot Island, Ohio River, asked by Pittsburg and Lake Erie Railroad Company and by the Pittsburg Coal Exchange. February 3, 1905, bridge across the Monongahela River at Hazelwood, proposed by the Eastern Railroad Company. June 2, 1905, rebuilding bridge across mouth of Chartiers Creek, by Pittsburg and Lake Erie Railroad Company. Examinations and reports were made on twenty-two applications for permits for miscellaneous structures in the rivers beyond the harbor lines.

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E E 5.

OPERATING AND CARE OF LOCKS AND DAMS NOS. 1 AND 6, OHIO RIVER.

A detailed description of the operation of these locks during the fiscal year ending June 30, 1905, will be found in the attached reports of Assistant Engineers J. W. Arras and W. H. Chadbourn, jr.

Allotment of funds.

August 3, 1885	$5,865.00	July 23, 1897	$9,898.62
July 10, 1886	12,015.00	November 20, 1897	400.00
January 28, 1887	6,700.00	July 26, 1898	9,620.71
July 1, 1887	12,355.00	February 7, 1899	3,000.00
February 25, 1888	3,500.00	June 24, 1899	1,200.00
July 11, 1888	18,015.00	July 19, 1899	23,459.69
August 20, 1889	12,073.00	January 13, 1900	3,230.00
May 14, 1890	2,000.00	June 18, 1900	45,000.00
July 17, 1890	14,752.00	July 17, 1900	47,456.07
October 7, 1890	14,800.00	February 26, 1901	2,000.00
July 10, 1891	10,338.00	June 28, 1901	10,000.00
July 21, 1892	11,831.48	July 18, 1901	42,530.54
June 27, 1893	1,300.00	August 8, 1902	23,889.09
July 22, 1893	12,253.82	July 20, 1903	65,107.55
July 18, 1894	12,459.02	July 21, 1904	2,512.21
May 25, 1895	450.00	August 3, 1904	[a] 18,500.00
July 9, 1895	30,661.54		
July 28, 1896	15,531.57	Total	[b] 505,904.91
May 17, 1897	1,200.00		

ABSTRACT OF CONTRACT IN FORCE.

Building a concrete wall at Davis Island dam, Ohio River.

Contractor: Rodgers & Abel, Pittsburg, Pa.
Rates: Excavation, 30 cents per cubic yard; concrete, $4.39 per cubic yard; steel, 3 cents per pound.
Date of approval: [c]
Date of beginning work: September 26, 1904.
Date of expiration: December 25, 1904.

Removing old bear-trap gate, remodeling foundation and piers, and building and erecting new bear-trap gate at Davis Island dam, Ohio River.

Contractor: Baker Contract Company, Pittsburg, Pa.
Rates: Excavation, $1 per cubic yard; concrete, $8 per cubic yard; oak timber, $100 per M feet B. M.; Allegheny River pine, $100 per M feet B. M.; bolts, washers, driftbolts, etc., 6 cents per pound; medium steel, 7 cents per pound; cast steel, 8 cents per pound; cast iron, 6 cents per pound; concrete and stone to be cut out, $20 per cubic yard; old gate, valves, iron, and timbers to be removed, $2,000.
Date of approval: July 31, 1905.
Date of beginning work: August 21, 1905.
Date of expiration: November 30, 1905.

[a] Lock No. 6.
[b] Of this amount there was undrawn or deposited $1,010.
[c] Emergency.

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Building 435 linear feet of movable dam, together with two abutments and two piers, on the site of the present fixed dam; also rebuilding the apron of the present fixed dam, at the back channel, Davis Island, Ohio River.

Contractor: The Dravo Contracting Company, Pittsburg, Pa.
Rates: Common excavation, 75 cents per cubic yard; common filling, 75 cents per cubic yard; stone, $3 per cubic yard; concrete, $7.70 per cubic yard; oak timber (permanent), $60 per M feet B. M.; hemlock timber, $35 per M feet B. M.; white pine timber (permanent), $40 per M feet B. M.; oak sheet piling, $70 per M feet B. M.; cast iron, 7½ cents per pound; wrought iron and steel, 7½ cents per pound; bolts, nuts, washers, spikes, etc., 7½ cents per pound; rectangular tile pipe, 25 cents per linear foot.
Date of approval: November 23, 1903.
Date of beginning work: May 25, 1904.
Date of expiration: One hundred and twenty-five fair working days.

REPORT OF MR. J. W. ARRAS, ASSISTANT ENGINEER.

Dam No. 1.—This work was in the local charge of Mr. William Martin, assistant engineer, until May 8, 1905, at which time it was assigned to my supervision.

Apart from the usual repairs and renewal of horses, chanoine wickets, props, etc., no material alterations were made in the movable dam proper during the year.

The bear-trap gate continued in service, but its condition is such as to render it liable to complete collapse at any time. Plans were prepared for its reconstruction, and on June 26 bids were opened for removal of the old gate, remodeling of its piers and foundation, and erection in its place of a new gate. The gate proposed will be of wood, heavily banded with steel, proportioned on a basis of 100 upward lifting force to 66 downward pressure. It is designed to be built much stronger than the original gate. The contract was awarded to the Baker Contract Company for $19,500. The purpose is that the work shall be finished by the end of the present working season.

While the lock was out of service during the past winter the wheels of the lock gates were renewed, and balanced butterfly valves substituted for the old valves in the upper lock gate.

At the beginning of the year the dam across the back channel at Davis Island was in course of reconstruction by The Dravo Contracting Company, of Pittsburg, Pa., under a contract dated October 17, 1903. About 150 linear feet of the old fixed dam had been dismantled and 2,300 cubic yards of excavation made. The work was prosecuted vigorously and was practically completed about the end of October, 1904. The structure comprises a fixed concrete dam with a movable crest of the Chittenden drum type having a vertical height of 5 feet above the fixed structure. Two abutments and two piers divide the movable feature into three weirs, two of which are each 101 feet 3 inches wide and the remaining one 202 feet 6 inches wide. The drums are composed of wooden lagging over a steel framework, and are in lengths of 33 feet 9 inches. Those forming any weir or bay are operated together, although their individual movements may be independent of each other.

When the work was completed the stage of water in the rivers was too low to permit of the necessary experimental operations of the drums. Consequently after an initial trial, which was not altogether satisfactory, the cofferdam above the structure was removed and an increase in the stage of water sufficient for a proper test of the drums awaited. Unfortunately the river did not rise materially until late in the month of December, when a rise of such height occurred as to force down the entire dam. This rise also carried over the drums all of the loose gravel, clay, and débris constituting the remains of the cofferdam, filling them into the narrow spaces about the drums and rendering the latter temporarily inoperative. In this condition they remained until spring, when, owing to unusually early low water, necessitating the raising of Davis Island pool, a temporary inexpensive fixed dam was erected on the concrete structure above the hinges of the drums. Later the gravel and silt deposits in the culverts and about the drums were partially removed, and at the end of the year about one-half of the drums had been released and raised to their proper height.

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The following is a statement of the materials furnished and placed and the work performed in the reconstruction of the back-channel dam:

Common excavation and filling	cubic yards	9,584
Stone filling	do	101
Concrete	do	4,695
Oak timber	feet B. M.	57,295
Hemlock and white-pine timber	do	31,667
Cast iron	pounds	35,865
Wrought iron, steel, bolts, nuts, washers, etc	do	101,034
Rectangular tile pipe	linear feet	576

The total cost of the structure during the year was $59,166.12.

When Davis Island dam was built the esplanade at the lock was constructed at about the elevation of the lock walls—approximately only 17 feet above the navigable pass sill of the dam. In consequence the power plant for operating the lock and other buildings were frequently flooded by ordinary freshets. In order to avoid this and to generally improve the condition and appearance of the Government property at the lock, a contract was entered into with Rodgers & Abel, of Pittsburg, Pa., under date of September 16, 1904, to erect a concrete wall about 8 feet in height above the level of the landlock wall and extending from the lock master's dwelling to the upper end of the lock. This work was commenced on October 14 and practically completed on December 20, 1904.

Materials furnished and placed and work performed by Rodgers & Abel were as follows:

Excavation	cubic yards	335
Concrete	do	927
Steel	pounds	16,960

The total cost of the above work was $4,678.83.

Arrangements were also made with the Rodgers Sand Company to deposit slag and other waste material upon the Government property behind the lock and upper guide wall. Until the end of the fiscal year about 18,000 cubic yards of such material had been deposited and partly graded by the regular force at the lock.

At the beginning and end of the fiscal year the movable dam was up. During the year it was maneuvered as follows:

Raised.	Lowered.	Time up.
		Days.
	July 7, 1904	7
July 18, 1904	December 25, 1904	160
May 4, 1905	May 12, 1905	8
May 22, 1905	June 8, 1905	17
June 16, 1905	June 19, 1905	3
June 30, 1905		
Total		195

REPORT OF MR. W. H. CHADBOURN, JR., ASSISTANT ENGINEER.

Dam No. 6.—This lock and dam was placed in operation early in August, though not entirely completed. The chanoine dam was raised for the first time August 4–5, but the bear traps were not successfully raised until August 17, the low water prevailing at the time necessitating two temporary dams to be built above the weirs in order to secure sufficient head.

The operation of this lock and dam has proved to be very satisfactory in every particular except the bear trap and A frame weir. The lock gates and machinery of improved design have been operated without trouble of any kind, and the maneuvers of the chanoine dam have been made with speed and ease.

The bear traps quickly developed weakness in their design and warped very badly, both in raising and lowering, which defect we have not been able to overcome. They do not rise with the calculated head, but require a head between pools of 4 feet, which is difficult to secure with so much of the entire dam automatic, viz, 25 per cent. However, we did succeed this spring in getting the bear traps up without any temporary means, due to a slight rise occurring after the raising of the chanoine dam.

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The A frame weir has been maneuvered on account of a large gravel bank lying immediately above it, which it was feared would wash down over the weir when down and prevent it being raised, and also on account of doubt as to the possibility of replacing the bay of needles closing the gap between the last A frame and the abutment with any head on the dam.

Considerable scour of the river bed developed around the piers both above and below the bear-trap foundations, reaching down nearly to the bottom of the concrete at the head of the piers and along the upper edge of the foundation. The scour below the grillage reached nearly to bed rock, or about 30 feet below sill reference, and was very abrupt just below the grillage. About 2,000 tons of riprap was placed to protect the piers and foundations from scour.

Navigation is much hampered at the upper approach to this lock by reason of a high bar extending from about 100 feet above the lock to the upper end of the guiding wall. This bar ranges from 4 to 6 feet above sill reference, and while the pool is filling there is not enough water on the bar for the majority of the steamers. It is expected to arrange shortly to dredge this bar, and thus remove this trouble.

During the year the dam was raised three times and lowered three times, as follows:

Raised.	Lowered.	Time up.
		Days.
August 17, 1904	August 26, 1904	10
August 30, 1904	December 12, 1904	103
May 24, 1905	June 7, 1905	15
Total		128

Classified statement of expenditures incurred in operating and care of Dams Nos. 1 and 6, Ohio River, during the fiscal year ending June 30, 1905.

Item.	Davis Island Dam (No. 1).	Dam No. 6.[a]	Total.
Salaries and wages for regular hired labor force	$10,000.00	$7,166.07	$17,166.07
Miscellaneous supplies and services	2,465.00	2,214.19	4,679.19
Miscellaneous repairs	4,925.00	4,224.14	9,149.14
Grading grounds	8,710.18		8,710.18
Rebuilding:			
Bear-trap dam	1,360.44		1,360.44
Back-channel dam	59,166.12		59,166.12
Contingencies	1,470.28	2,437.53	3,907.81
Total	88,097.02	16,041.93	104,138.95

[a] From August 3, 1904, to end of fiscal year.

Traffic through Locks and Dams Nos. 1 and 6, Ohio River, for the fiscal year 1905, as measured by the commerce through Lock and Dam No. 1.

	Number.	Tons.[a]		Number.	Tons.[a]
Packets	294		Coal		2,851,079
Towboats	2,270		Iron and steel products		99,612
Model barges	120		Sand		20,808
Coal boats	2,290		Gravel		32,285
Barges	4,194		Lumber		20,750
Flats	3,099		Miscellaneous		58,825
Rafts	15				
Miscellaneous	566		Total	12,788	3,083,359

[a] 2,000 pounds.

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E E 6.

CONSTRUCTION OF LOCKS AND DAMS NOS. 2 TO 7, INCLUSIVE, OHIO RIVER IN PENNSYLVANIA.

A detailed description of the work done during the fiscal year ending June 30, 1905, will be found in the attached reports of Assistant Engineer J. W. Arras; First Lieut. Geo. R. Spalding, Corps of Engineers; First Lieut. E. N. Johnston, Corps of Engineers, and Assistant Engineer W. H. Chadbourn, jr.

Money statements.

CONSOLIDATED.

July 1, 1904, balance unexpended	$768,297.45
Amount appropriated by river and harbor act approved March 3, 1905	500,000.00
	1,268,297.45
June 30, 1905, amount expended during fiscal year, for works of improvement	518,160.30
July 1, 1905, balance unexpended	750,137.15
July 1, 1905, outstanding liabilities	14,868.71
July 1, 1905, balance available	735,268.44
July 1, 1905, amount covered by uncompleted contracts	954,321.39
Amount (estimated) required for completion of existing project	[a] 2,233,376.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	2,233,376.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

DAMS NOS. 2, 3, 4, AND 5.

July 1, 1904, balance unexpended	$717,375.86
Amount appropriated by river and harbor act approved March 3, 1905	500,000.00
	1,217,375.86
June 30, 1905, amount expended during fiscal year, for works of improvement	479,305.90
July 1, 1905, balance unexpended	738,069.96
July 1, 1905, outstanding liabilities	14,851.56
July 1, 1905, balance available	723,218.40
July 1, 1905, amount covered by uncompleted contracts	954,321.39
Amount (estimated) required for completion of existing project	[b] 1,281,376.00

[a] The river and harbor act of March 3, 1905, authorizes contract or contracts for the completion of Locks and Dams Nos. 2 to 5, at an additional expenditure not to exceed in the aggregate $1,281,376.

[b] The river and harbor act of March 3, 1905, authorizes contract or contracts for the completion of these locks and dams, at an additional expenditure not to exceed in the aggregate $1,281,376.

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Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	$1,281,376.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

DAM NO. 6.

July 1, 1904, balance unexpended	$41,939.25
June 30, 1905, amount expended during fiscal year, for works of improvement	36,755.72
July 1, 1905, balance unexpended	5,183.53
July 1, 1905, outstanding liabilities	17.15
July 1, 1905, balance available	5,166.38

DAM NO. 7.

July 1, 1904, balance unexpended	$8,982.34
June 30, 1905, amount expended during fiscal year, for works of improvement	2,098.68
July 1, 1905, balance unexpended	6,883.66
Amount (estimated) required for completion of existing project	952,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	952,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

September 19, 1890, construction of Lock and Dam No. 6	$250,000
July 13, 1892, construction of Lock and Dam No. 6 and purchase of land for No. 2	100,000
August 18, 1894, construction of Lock and Dam No. 6	75,000
March 2, 1895, construction of Lock and Dam No. 6	150,000
June 3, 1896:	
Construction of Lock and Dam No. 6	25,000
Construction of Locks and Dams Nos. 2, 3, 4, and 5 and purchase of sites for Nos. 3, 4, and 5	30,000
June 4, 1897:	
Construction of Dams Nos. 2, 3, and 4	400,000
Construction of Dam No. 6	300,000
July 1, 1898, continuing construction of Dams Nos. 2, 3, 4, and 5	595,000
March 3, 1899, continuing construction of Dams Nos. 2, 3, 4, and 5	400,000
June 6, 1900, continuing construction of Dams Nos. 2, 3, 4, and 5	595,000
June 13, 1902:	
Continuing construction of Locks and Dams Nos. 2, 3, 4, and 5	100,000
Completing Lock and Dam No. 6	175,000
Construction of Lock and Dam No. 7	23,000
March 3, 1903, continuing construction of Dams Nos. 2, 3, 4, and 5	300,000
March 3, 1905, completion of Locks and Dams Nos. 2, 3, 4, and 5 and the modification of said locks and dams and of Lock and Dam No. 6 so as to secure a stage of 9 feet in the pools belonging thereto	500,000
Total	4,018,000

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ABSTRACT OF CONTRACTS IN FORCE.

Building 376 feet of chanoine dam and a bear-trap dam 102 feet 4 inches wide, Dam No. 2, Ohio River.

Contractor: E. Brown Baker, Pittsburg, Pa.

Rates, original contract: Excavation, 90 cents per cubic yard; hemlock timber, $60 per M feet B. M.; oak timber, $65 per M feet B. M.; white-pine timber, $60 per M feet B. M.; cast iron, 5 cents per pound; medium steel, 6 cents per pound; bolts and washers, 4 cents per pound; concrete, $7.25 per cubic yard; reenforcing steel, 3 cents per pound; stone filling (crib), $3 per cubic yard; riprap stone, $3.50 per cubic yard; common filling, 40 cents per cubic yard; driftbolts, 4 cents per pound; 3½-inch galvanized-iron pipe, 50 cents per linear foot; 4-inch galvanized-iron pipe, 60 cents per linear foot; brick paving, $4 per square yard; block stone paving, $4 per square yard; sheet piling, $70 per M feet B. M.

Rates, supplemental contract: For making certain changes in location of hurters and in dimensions of horses and props in a portion of Dam No. 2, made necessary by the change of project from a 6-foot to a 9-foot stage: For setting 50 hurters in pass, lump sum, $650; for removing horse boxes, making certain alterations, and replacing same in work, lump sum, $400; for furnishing and placing horses, props, wickets, and quoins in pass and weir, iron and steel in horses, props, and wickets, 7 cents per pound; cast iron in quoins, 6 cents per pound; white-oak timber, $90 per M feet B. M.

Dates of approval: Original contract, February 13, 1904; supplemental contract, June 7, 1905.

Date of beginning work: April 17, 1904.

Date of expiration: April 17, 1906.

Building foundations for two lock-keepers' houses at Dam No. 2, Ohio River.

Contractor: The Dravo Contracting Company, of Pittsburg, Pa.

Rates: Excavation, 40 cents per cubic yard; concrete, $6.20 per cubic yard.

Date of approval: [a]

Date of beginning work: October 5, 1904.

Date of expiration: January 5, 1905.

Dredging approach to navigable pass at Dam No. 2, Ohio River.

Contractor: The Ohio River Contract Company, Evansville, Ind.

Rate: 29 cents per cubic yard.

Date of approval: June 15, 1905.

Date of beginning work: June 22, 1905.

Date of expiration: Dependent upon stage of water.

Building a power house at Dam No. 2, Ohio River.

Contractor: Brady Construction Company, Fairmont, W. Va.

Rate: $12,459.

Date of approval: November 10, 1904.

Date of beginning work: December 3, 1904.

Date of expiration: October 3, 1905.

Building about 100 feet of chanoine dam, 2 bear-trap dam foundations, each 93 feet long, and a chanoine weir 160 feet long, 3 piers and abutment, Dam No. 3, Ohio River.

Contractor: The Ohio River Contract Company, Evansville, Ind.

Rates: Excavation, 80 cents per cubic yard; hemlock timber, $50 per M feet B. M.; oak timber, $80 per M feet B. M.; wrought iron and steel (including all metal except cast iron, bronze, and pipe), 6 cents per pound; cast iron, 6 cents per pound; bronze, 50 cents per pound; galvanized-iron pipe, 4-inch diameter, $1 per linear foot; galvanized-iron pipe, 3-inch diameter, 90 cents per linear foot; black pipe, 2-inch diameter, 50 cents per linear foot; round piling, 65 cents per linear foot; sheet piling, $90 per M feet B. M.; concrete, $8.50 per

[a] Emergency.

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cubic yard; large stone, $3 per cubic yard; common filling, 75 cents per cubic yard; paving, vitrified brick, $3 per square yard; crib decking, $60 per M feet B. M.

Date of approval: June 10, 1905.
Date of beginning work: July 3, 1905.
Date of expiration: October 31, 1906.

Building 352 feet of chanoine dam, Dam No. 4, Ohio River.

Contractor: Baker & Egan, Pittsburg, Pa.

Rates, original contract: Excavation, 80 cents per cubic yard; hemlock timber, $50 per M feet B. M.; oak timber, $85 per M feet B. M.; cast iron, 5 cents per pound; cast iron, furnished by the United States, 1¾ cents per pound; medium steel, 7 cents per pound; medium steel, furnished by the United States, 1¾ cents per pound; bolts and washers, 5 cents per pound; concrete, $6 per cubic yard; reenforcing steel, 5 cents per pound; stone filling (crib), $3 per cubic yard; stone filling (above dam), $3 per cubic yard; common filling, 60 cents per cubic yard; drift bolts, 5 cents per pound; 3½-inch galvanized-iron pipe, 75 cents per linear foot; 4-inch galvanized-iron pipe, $1 per linear foot; sheet piling, 90 cents per M feet B. M.

Rates, supplemental contract: For change of plan in the dam the same unit prices to be paid for completed work in place as stated in original contract. The white-oak piles, not mentioned in the original contract, $10 each in place.

Date of approval: Original contract, August 13, 1904; supplemental contract, March 22, 1905.
Date of beginning work: August 25, 1904.
Date of expiration: November 1, 1905.

Building about 98 feet of chanoine dam, 2 bear-trap dam foundations, each 93 feet long, a chanoine weir 160 feet long, 3 piers and abutment, Dam No. 4, Ohio River.

Contractor: Baker Contract Company (Incorporated), Pittsburg, Pa.

Rates: Excavation, 80 cents per cubic yard; hemlock timber, $55 per M feet B. M.; oak timber, $90 per M feet B. M.; wrought iron and steel (including all metal except cast iron, bronze, and pipe), 7 cents per pound; cast iron, 6 cents per pound; bronze, 50 cents per pound; galvanized-iron pipe, 4-inch diameter, $1 per linear foot; galvanized-iron pipe, 3-inch diameter, 75 cents per linear foot; black pipe, 2-inch diameter, 50 cents per linear foot; round piling, 65 cents per linear foot; sheet piling, $90 per M feet B. M.; concrete, $8 per cubic yard; stone crib filling, $3 per cubic yard; large stone, $3 per cubic yard; common filling, 60 cents per cubic yard; paving, vitrified brick, $3 per square yard; riprap stone bank covering, $3 per cubic yard; crib decking, $60 per M feet B. M.

Date of approval: May 17, 1905.
Date of beginning work: June 9, 1905.
Date of expiration: October 31, 1906.

Building about 303 feet of chanoine dam, 2 bear-trap dam foundations, each 93 feet long, a chanoine weir 96 feet long, 3 piers and abutment, Dam No. 5, Ohio River.

Contractor: The Dravo Contracting Company, Pittsburg, Pa.

Rates: Excavation, 70 cents per cubic yard; hemlock timber, $50 per M feet B. M.; oak timber, $90 per M feet B. M.; crib decking timber, $55 per M feet B. M.; cast iron, 5 cents per pound; wrought iron and steel (including all metal except cast iron and bronze), 7 cents per pound; bronze, 40 cents per pound; concrete, $7.50 per cubic yard; stone filling (crib), $2.25 per ton; riprap stone, $2.25 per ton; common filling, 50 cents per cubic yard; 3-inch galvanized-iron pipe, $1 per linear foot; 4-inch galvanized-iron pipe, $1.25 per linear foot; 2-inch black iron pipe, 40 cents per linear foot; brick paving, $1.50 per square yard; sheet piling, $95 per M feet B. M.; piling (round or bearing), 60 cents per linear foot.

Date of approval: May 13, 1905.
Date of beginning work: June 4, 1905.
Date of expiration: October 31, 1906.

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Building two lock keepers' houses, except foundations, at each of Dams 2 and 5, Ohio River.

Contractor: William F. Panke, Pittsburg, Pa.
Rates: $4,800 for each building at each site.
Date of approval: March 18, 1905.
Date of beginning work: April 10, 1905.
Date of expiration: September 10, 1905.

Building concrete foundations for two lock keepers's houses at each of Dams Nos. 3 and 4, Ohio River.

Contractor: J. Carroll Barr, Economy, Pa.
Rates: Excavation, 55 cents per cubic yard; concrete, $5.73 per cubic yard at each dam.
Date of approval.[a]
Date of beginning work: September 29, 1904.
Date of expiration: December 29, 1904.

Building a power house at each of Dams Nos. 3, 4, and 5, Ohio River.

Contractor: Brady Construction Company, Fairmont, W. Va.
Rates: $12,789 for each building.
Date of approval: July 3, 1905.
Date of beginning work: July 25, 1905.
Date of expiration: January 25, 1906.

REPORT OF MR. J. W. ARRAS, ASSISTANT ENGINEER.

Dam No. 2.—This work was in local charge of Mr. William Martin, assistant engineer, until May 8, 1905, when it was assigned to my supervision.

At the beginning of the fiscal year the lock walls, gate recesses, and guide walls, and 500 linear feet of navigable pass of the dam were practically completed for a 6-foot navigation. Also the foundation for the pewer house had been built, and considerable embankment back of the land wall of the lock made.

The Evansville Contract Company, under a contract dated September 18, 1902, had removed 61,698 cubic yards of material from the new channel at the lock, 22,000 cubic yards of which had been deposited back of the land lock wall, as required. Under this contract there remained then to be dredged 28,302 cubic yards, of which 13,000 cubic yards was to be placed in the embankment behind the lock. This contract was completed on May 4, 1905.

Under a contract dated January 22, 1904, E. Brown Baker, of Pittsburg, Pa., was engaged in the construction of 376 linear feet of chanoine dam, and a bear-trap gate 102 feet 4 inches wide, with two masonry piers and an abutment. Under this contract a considerable amount of dredging had been done, and 260 linear feet of abutment crib substructure sunk into position. Favorable water conditions during the season of 1904, continuing late into the winter, enabled this work to progress satisfactorily. During the spring of 1905 numerous small rises greatly impeded the work. At the end of the fiscal year the crib-work substructure of the remainder of the dam had been completed; practically all of the concrete foundations, pier, and abutment constructed for a 6-foot navigation; nearly all of the fixed irons for chanoine dam and bear-trap gate placed; the movable irons and wickets of the chanoine weir put in position, and the movable parts of the bear-trap leaves about one-third constructed.

The river and harbor act approved March 3, 1905, provided for the completion of this lock and dam for a 9-foot navigation. Pursuant to such authority the necessary steps were immediately taken to raise the masonry of the piers and abutment of the dam, and to alter all of the movable parts thereof to meet the requirements of the proposed height. To this end such of the wickets, horses, and props as could readily be altered to suit the weirs of other dams under construction below were distributed among those works, and arrangements made for the alteration of old and the construction of new parts for the navigable pass of Dam No. 2.

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[a] Emergency.

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The materials placed and work performed under contract with E. Brown Baker during the fiscal year were as follows:

Excavation	cubic yards	16,080
Hemlock timber	feet B. M.	496,835
Oak timber	do	189,534
White-pine timber	do	31,436
Cast iron	pounds	159,702
Medium steel	do	305,034
Driftbolts, washers, etc	do	102,221
Concrete	cubic yards	9,592
Reenforcing steel	pounds	48,267
Stone filling (crib) and riprap stone	cubic yards	6,122
Common filling	do	5,898
3½ and 4 inch galvanized-iron pipe	linear feet	1,678
Sheet piling	feet B. M.	101,490

Prior to the construction of the work under the above contract, the running channel of the Ohio River at the site of Dam No. 2 followed closely the right bank or the abutment end of the dam. The construction of that end of the dam necessarily involved the abandonment of the old channel, and compelled navigation to adopt the proposed future channel over the navigable pass adjoining the lock. The excavation through the chute between the lock and Merrimans bar, by the Evansville Contract Company, was not at that time sufficient to satisfy the needs of navigation. Consequently in the season of 1904 one of the dredges of the Monongahela and Western Dredging Company, of Pittsburg, Pa., was employed to assist in providing a proper channel. Again, in the spring of 1905 the same dredging company furnished one dredge, which, together with the United States Government dredge, devoted nearly two months to widening the new channel and removing the lower end of Merrimans bar. During the year these dredges removed 78,045 cubic yards of gravel and bowlders, and greatly improved the condition of navigation. Under date of May 29, 1905, a contract was entered into with the Ohio River Contract Company, of Evansville, Ind., for dredging an additional amount of from 37,500 to 75,000 cubic yards of material. Work under this contract was commenced on June 12, and at the end of the year there had been removed 9,111 cubic yards. The total amount of material dredged from the new channel and at the foot of Merrimans bar during the year was 115,458 cubic yards. Thirteen thousand cubic yards of this material was placed behind the land wall of the lock, and the remainder was deposited in the old channel on the right of Merrimans bar, below the weirs of the dam. The result of this dredging has been to produce a clean channel 300 feet wide at the lock and from 400 to 500 feet in width below the lock, and to remove the entire foot of the bar, so that on recent navigable stages navigation experienced little or no difficulty in passing through the new channel with large fleets of loaded craft.

Under an emergency contract dated September 15, 1904, The Dravo Contracting Company, of Pittsburg, Pa., built the concrete foundations for two lock houses. The work was performed in October and November, 1904.

Under a contract dated October 28, 1904, the Brady Construction Company, of Fairmont, W. Va., is engaged in erecting a brick power house at the lock. The walls of the building have been practically completed.

Two brick lock houses, except foundations, are under construction by William F. Panke, of Pittsburg, Pa., under a contract dated February 28, 1905, at a cost of $4,800 each. Materials have been delivered and the buildings erected to the second-floor level.

A contract with the Evansville Contract Company, of Pittsburg, Pa., dated September 20, 1902, for paving the slopes of the esplanade was abrogated.

About the 1st of May, 1905, the repair crew of United States crane boat *No. 2*, from the Monongahela River, proceeded to cut out the deteriorated natural-cement concrete from the walls of the gate recesses at Lock No. 2, to remove the deposits of gravel, clay, concrete spalls, mud, etc., from the recesses, and to reconstruct with Portland-cement concrete the faces of the recess walls and reset parts of the stone masonry. Although interfered with considerably by high water, at the close of the year all deposits and waste materials had been removed from the upper gate recess and the concrete facing of the walls completed. At the lower recess all worthless concrete had been cut out to the water level and about one-half of the waste materials and deposits removed. The materials removed are being utilized in raising the esplanade to its proper elevation around the lock buildings.

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REPORT OF FIRST LIEUT. GEO. R. SPALDING, CORPS OF ENGINEERS.

Dam No. 3.—This work was in local charge of Mr. Wm. Martin, assistant engineer, from July 1, 1904, to May 1, 1905; of Mr. W. H. Chadbourn, jr., assistant engineer, from May 2 to June 2, 1905, and was assigned to my supervision on June 3, 1905.

At the beginning of the fiscal year the masonry of the lock was completed and a portion of the foundation for the power house was built. The building of 600 feet of chanoine dam in the navigable pass by the Evansville Contract Company was commenced in the fall of 1903, under contract dated September 19, 1903, and an unsuccessful attempt was made to sink the foundation crib, which was carried away by high water. This 600 feet of dam is of the crib-foundation type, and during the present fiscal year the 400 feet of dam next the lock was completed, the foundation being two cribs of 200 feet each. The crib for the remaining 200 feet of dam was sunk in two sections of 100 feet each. The concrete and iron of this 200 feet is still to be completed, the high stage of river having prevented the continuance of the work up to June 30.

Under this contract the following material was placed and work done:

Excavation	cubic yards	15,015
Hemlock timber	feet B. M.	548,508
Oak timber	do	130,800
Concrete	cubic yards	2,616
Stone crib filling	do	4,245
Stone filling below crib	do	1,620
Common crib filling	do	4,284
Common filling above dam	do	3,000
Cast iron	pounds	106,397
Medium steel	do	327,197
Reenforcing steel	do	22,264
Galvanized-iron pipe, 3½-inch	linear feet	800
Galvanized-iron pipe, 4-inch	do	400
Sheet piling	feet B. M.	72,960

On May 24, 1905, contract was entered into with the Ohio River Contract Company, approved June 10, 1905, for building 100 feet of chanoine dam; 2 bear-trap dam foundations, each 93 feet long; 1 chanoine weir, 140 feet long; 3 piers, and the abutment. Under this contract the excavation for the abutment is about completed, about 8,102 cubic yards having been removed. The plant for the work has been installed and work on the cofferdam will begin at once.

In September, 1904, contract was entered into with J. Carroll Barr for building concrete foundation for the two lock houses, and this work was completed on November 9, 1904. Work done:

Concrete	cubic yards	531
Excavation	do	262

In May, 1905, after public advertisement by poster and circular letter, bid of Arthur M. Bowman was accepted for raising the masonry walls of power-house foundations, and machinery piers in same, and the work was completed during same month. Work done:

Concrete	cubic yards	268.5
Tearing down damaged part of old wall	do	78.3
Brick masonry	do	12.6
Pointing	do	837.68

Contract was entered into June 10, 1905, with the Brady Construction Company, for building a power house. This work has not been commenced.

REPORT OF FIRST LIEUT. E. N. JOHNSTON, CORPS OF ENGINEERS.

Dam No. 4.—This work was in local charge of Lieut. A. B. Putnam, Corps of Engineers, until May 8, 1905, when it was assigned to my supervision.

At the beginning of the fiscal year the lock had been completed, except the gates and operating machinery, and 250 feet of foundation of the chanoine dam for navigable pass had been built, the completed section being on that end of the navigable pass which adjoins the river wall of the lock.

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The work done during the year was as follows: About 200 cubic yards of riprap stone were placed along the lower end of the land wall of the lock, along the lower guide wall, and just below the lower gate track. This work was done by hired labor, the stone being on hand.

A contract was entered into August 2, 1904, with Baker & Egan, of Pittsburg, Pa., for the construction of 352 feet of chanoine dam, complete, for the navigable pass, the section to join the completed portion. It was later considered desirable to change the type of this foundation in order that it might be built more economically and more quickly, so the original contract was amended by supplementary articles of agreement dated March 1, 1905. The contractors are engaged in preparations for work on a large scale. The work done under this contract is as follows:

Excavation	cubic yards	965
Fill	do	25

During the winter plans were prepared for the remaining 98 feet of chanoine dam for the navigable pass, for 2 bear-trap weirs, 3 piers, a chanoine weir 160 feet long, and abutment. Plans were also prepared for the power house and for the bear-trap gates. In June, 1905, plans were prepared for the lock gates.

Contract was entered into on September 9, 1904, with J. Carroll Barr, for the construction of foundations for two lock keepers' houses. This work was completed between September 13 and November 26, 1904. The work done was as follows:

Excavation	cubic yards	220
Concrete	do	322

The Baker Contract Company, under written agreement dated April 10, 1905, completed the construction of foundation piers for the power house and the building of new concrete wall to replace the parts of the rubble masonry walls which were in poor condition. The work done was as follows:

Old masonry torn down	cubic yards	116.4
Gravel filling for power house	do	655
Concrete	do	263.8
Brick masonry	do	13.16

Before the work on power-house foundations could be begun it was necessary to have a large quantity of dirt and rubbish—149 cubic yards—removed from the bottom of the foundation. This work was done by the Baker Contract Company under oral agreement.

On May 6, 1905, contract was entered into with the Baker Contract Company for the construction of 98 feet of chanoine dam for navigable pass, 2 bear-trap weir foundations, 3 piers, a chanoine weir (complete), and abutment. Under this contract the contractors have been engaged in constructing a cofferdam to inclose the three piers and bear-trap weirs, in excavating, and in construction of cable-way towers, and general work of a preparatory nature. The amount of work done is as follows:

Excavation	cubic yards	16,110
Test piles driven:		
Round piles	linear feet	80
Sheet piles	feet B. M.	1,008

While the completed 250 feet of navigable pass was under construction and inclosed within a cofferdam a bar formed just below the cofferdam. It was necessary that this bar be removed before the channel on west side of the river could be closed. The dredge *Western*, with steamer and scows, was leased from the Monongahela and Western Dredging Company for this work. Eighteen thousand six hundred and ninety-seven cubic yards, scow measurement, were removed, at a cost of $2,601.50.

Preparatory to dredging operations a survey was made of the river near the site of the dam. A survey was also made of the land on the abutment side of the river in order that correct plans for a new type of abutment could be formulated.

On June 10, 1905, contract was entered into with the Brady Construction Company for the construction of the power house. No work has yet been done.

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REPORT OF MR. W. H. CHADBOURN, JR., ASSISTANT ENGINEER.

Dam No. 5.—At the beginning of the fiscal year the masonry of the lock was practically completed for the 6-foot project, about 100 in length of the chanoine-dam foundation was completed, and more or less work on 300 feet additional had been done.

During the fiscal year the chanoine-dam foundation for a distance of 397 feet from the lock wall was completed, under contract with Robert A. Cummings, dated August 16, 1902.

The following is a list of materials placed and excavation done during fiscal year:

Hemlock timber	feet B. M.	4,458
Oak timber	do	14,907
Sheet piling	do	16,338
Stone filling	cubic yards	1,253
Common filling	do	3,616
Common excavation	do	2,351
Iron and steel	pounds	186,840
Wire rope	linear feet	6,450
Wire-rope clips	pieces	486
Iron pipe, 2-inch	linear feet	766
Iron pipe, 3-inch	do	631
Iron pipe, 4-inch	do	322
Concrete	cubic yards	5,304

The wickets were not included in this contract, and the hurters were set suitable for either a 6-foot or 9-foot project, so that the change in the project causes no loss at this work.

The lock was coffered at both ends and unwatered from July 1 to October 6, except during a period of eight days of high water in July, while the coffer around the dam was unwatered, both to relieve the strain on the injured river wall and to avoid the flow of water under the wall from the lock to the coffer outside. Advantage was taken of the occasion of the lock being unwatered to level the heavy riprap previously dumped in to protect the floor from scour and to better place same. Pipes were also placed in the power conduit across the lock. All of the above work was done during calendar year 1904.

A contract was entered into with the Dravo Contracting Company, under date of May 4, 1905, for all the foundation work to complete the dam and some of the superstructure. Under this contract the greater portion of the excavation was done, a cofferdam was nearly completed around the weirs, and the bearing piles for the abutment wall were driven.

Preparations have been made to unwater the lock so as to cut down the lower lock sill to permit of a 9-foot draft over same from No. 6 pool. This work will be done by hired labor and use of United States plant. A temporary dam was constructed across the head of the lock; a pumping plant has been installed and is almost ready for operation, and much of the material is on hand.

A contract was entered into with William F. Panke, dated February 28, 1905, for two lock houses; but little was done under this contract.

A contract was entered into with the Brady Construction Company for a power house. No work has been done yet under this contract. The power-house foundation was raised 5 feet 3 inches this spring, so as to bring the floor of the building above all freshets except the one extreme of 1884.

Dam No. 6.—At the beginning of the fiscal year the lock and dam was practically completed, except the lock gates and some of the machinery, considerable grading and paving, and such minor things.

The lock gates were completed and tested August 3, 1904; the raising of the dam commenced immediately, and the entire dam was successfully raised on August 17, 1904. Some little trouble was had in raising the bear traps, due to the gravel that had deposited in the conduits on top of the leaves and in every available opening, which had to be cleaned off; also, the stage of water was so low that to get sufficient head to raise the bear traps a light temporary dam had to be built above the weirs.

The gate recesses were decked over with iron, and some additions to the paving on the abutment side were made. A needle flat, costing $375.97, was constructed by hired labor, and several minor works of improvement were completed, such as constructing steps on lock walls, pump pit, drains, etc.

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Dam No. 7.—The site of Dam No. 7 is in Pennsylvania, 36.5 miles below Pittsburg, Pa. The lock will be located on the left bank. The entire site has been secured. The lock plans are practically completed, and the plans for the entire work are roughly outlined and will shortly be completed.

E E 7.

DREDGING POOL 6, OHIO RIVER.

An allotment of $20,800 was made June 12, 1905, from the appropriation of $300,000 made by act of March 3, 1905, for the general improvement of the Ohio River, for the removal of about 32,000 cubic yards of material from the bar in upper approach to Lock No. 6. Specifications are in course of preparation, and it is intended to do the work by contract after public advertisement.

No money has been expended during the year.

Money statement.

Amount allotted from appropriation for improving Ohio River, act of March 3, 1905	$20,800.00
July 1, 1905, balance unexpended	20,800.00

E E 8.

CONSTRUCTION OF LOCKS AND DAMS AT HERR ISLAND, ABOVE HEAD OF SIXMILE ISLAND, AND AT SPRINGDALE, ALLEGHENY RIVER, PENNSYLVANIA.

A detailed description of the work done during the fiscal year ending June 30, 1905, will be found in the attached report of Assistant Engineer J. W. Arras.

Money statement.

July 1, 1904, balance unexpended		$173,269.11
June 30, 1905, amount expended during fiscal year, for works of improvement		161,311.92
July 1, 1905, balance unexpended		11,957.19
July 1, 1905, outstanding liabilities		437.36
July 1, 1905, balance available		11,519.83
July 1, 1905, amount covered by uncompleted contracts		216,546.47
Amount (estimated) required for completion of existing project		[a] 281,226.63
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905		281,226.63
Submitted in compliance with requirements of sundry civil act of June 4, 1897.		

[a] The river and harbor act of March 3, 1905, authorizes contract or contracts for the completion of these locks and dams at an additional expenditure not to exceed in the aggregate $281,226.63.

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APPROPRIATIONS.

August 5, 1886	$37,500	June 4, 1897	$350,000
August 11, 1888	35,000	July 1, 1898	300,000
September 19, 1890	35,000	March 3, 1901	126,000
July 13, 1892	40,000	June 28, 1902	118,500
August 18, 1894	40,000		
June 3, 1896	50,000	Total	1,132,000

ABSTRACT OF CONTRACTS IN FORCE.

Building Dam No. 2 at Sixmile Island, Allegheny River.

Contractor: James H. McQuade Company, Pittsburg, Pa.
Rates: Gravel excavation, 60 cents per cubic yard; back fill, 60 cents per cubic yard; embankment, 60 cents per cubic yard; round piles, 45 cents per linear foot; sheet piles, $70 per M feet B. M.; oak timber, $70 per M feet B. M.; hemlock timber, $50 per M feet B. M.; stone crib filling, $2.50 per cubic yard; large stone, $2.50 per cubic yard; concrete, $7 per cubic yard; driftbolts, 5 cents per pound.
Date of approval: May 13, 1905.
Date of beginning work: June 14, 1905.
Date of expiration: November 30, 1906.

Building and erecting in place two pairs of steel lock gates and anchorages at Lock No. 2, Allegheny River.

Contractor: Penn Bridge Company, Beaver Falls, Pa.
Rates: White oak, $60 per M feet B. M.; iron, steel, and bronze, 4.88 cents per pound.
Date of approval: June 28, 1905.
Date of beginning work: July 18, 1905.
Date of expiration: July 31, 1906.

Building a lock master's dwelling at Lock No. 3, Allegheny River.

Contractor: Gloster R. Morrell, Tarentum, Pa.
Rates: Original contract, $3,350. Supplemental contract, $550 additional for replacing front foundation wall and pillars supporting front veranda, etc., carried away by flood.
Date of approval:[a] Supplemental contract, May 12, 1905.
Date of beginning work: September 17, 1904.
Date of expiration: June 24, 1905.

COMMERCIAL STATISTICS.

Commercial statistics are attached to report for operating and care of Locks and Dams Nos. 1 and 3, Allegheny River, and improving Allegheny River, Pennsylvania.

REPORT OF MR. J. W. ABRAS, ASSISTANT ENGINEER.

Lock and dam at Sixmile Island (No. 2).—Of this structure the lock and the abutment for dam were constructed by the Dravo Contracting Company, of Pittsburg, Pa., under a contract dated December 31, 1902, and the dam is being constructed by the James H. McQuade Company, Pittsburg, Pa., under a contract dated May 2, 1905.

[a] Emergency.

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At the beginning of the fiscal year the lock was completed, except the miter sills and lock floor, one-half of the upper guide wall, the lower guide wall, and the upper guard crib. The excavation for the abutment was made, nearly all of its cribwork substructure in place, and part of the sheet piling about the abutment driven.

The season of 1904 was an exceptionally favorable one for the prosecution of river construction work. The water continued low until very late in the fall, in consequence of which the contractor was enabled to practically finish the lock and abutment for Dam No. 2 about the end of the working season. Thereafter he devoted himself to restoring the bank, which had caved into the excavation for abutment during the previous season, and to the removal of such portions of the cofferdam as were no longer needed for the work. The contract was finally completed about the 1st of May, 1905.

Simultaneously with the construction of the lock the city of Pittsburg completed the extension of the 9-foot sewer from above the lock to a point 250 feet below it.

Under the contract for constructing the dam considerable quantities of materials and plant have been delivered at the site of the work; test piles to determine the character of the river bed have been driven, and preparations generally made for the immediate prosecution of the work.

The following materials were furnished and placed and work performed during the year by the Dravo Contracting Company:

Excavation	cubic yards	1,612
Concrete	do	6,114
Stone	do	3,049
Oak timber	feet B. M.	51,885
Hemlock timber	do	138,871
Driftbolts	pounds	14,301

Under the provisions of the contract for constructing the lock, all of the excavated materials not required for cofferdam purposes were placed behind the lock. The material excavated for the city sewer extension was necessarily also deposited back of the lock. In addition to these, however, there remained space behind the lock for at least 50,000 cubic yards of material. Owing to lack of funds no provision for this embankment was made under contract, but immediately after the completion of the lock the Pennsylvania Railroad Company was invited to deposit over the bank back of the lock and guide walls ashes, slag, and other waste materials, of which that company frequently has an abundant supply at its disposal. Under this arrangement about 8,000 cubic yards of materials had been deposited in the embankment at the end of the fiscal year.

Under date of June 9, 1905, a contract was let to the Penn Bridge Company, of Beavers Falls, Pa., for building and erecting in place steel lock gates at Lock No. 2.

Lock and dam at Springdale (No. 3).—The exceedingly favorable water conditions of the season of 1904 enabled the contractor to complete the timber crib work of the dam, which had previously been erected to from 4 feet above low water at the abutment to its full height at the lock. The last rise of consequence to pass over the unfinished dam occurred on July 7 and 8, 1904, at which time a run of 9 barges, 5 loaded coal-boat bottoms, 4 rafts, and 1 house boat passed over the structure. Thereafter no commerce passed over the dam. During the completion of the dam the lower lock gates were erected in place, being finished about the end of September. After the crib work of the dam had been finished there was placed on its upstream corner from lock to abutment a three-eighths-inch steel corner band 16 inches in width on each leg. The purpose of this band is to protect the timber decking of dam against injurious scour and the dangerous effects of ice gorges. The contractor succeeded in driving all of the piles along the upstream face of the dam, as required, but failed to complete the gravel backing above the dam, owing to the entire failure of the only sand dredge available for the purpose in that locality in the fall of 1904. Unfortunately, the stage of water also continued too low to permit another dredge to reach the work, and the back filling above the dam was postponed until the present season, when, owing to high water, it had not been completed at the end of the fiscal year.

On October 26, 1904, a small rise occasioned a break at the abutment, which, although inconsiderable in extent, was nevertheless of a serious nature. A leak of considerable force underneath the core wall of the abutment, evidently due

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to the failure of the contractor to properly sheet and back-fill the submerged crib work of the dam, caused the undermining and breaking down of the concrete paving of the abutment along the downstream edge of the core wall. In consequence the concrete core wall, 4 feet in thickness, was compelled to carry the full pool head of about 12 feet. Steps were immediately taken to reenforce the core wall with another concrete wall having an average thickness of 6 feet and well supported and backed with stone, the whole being properly paved with concrete. The work of repair was accomplished in about ten days.

The first considerable rise of the winter occurred on December 28. It attained a height of 8.3 feet over the crest of the dam. The effect of this stage of water upon the light, sandy clay bank for a length of 400 feet below the abutment was to undermine and cave it into the stream for a width of 25 to 40 feet within a period of about twenty-four hours. One of five houses standing on the edge of the bank was precipitated into the stream and the safety of the others threatened as well as that of the abutment of the dam. Steps were immediately taken to protect the bank below the abutment by depositing over the territory affected about 5,000 cubic yards of stone varying in size from one-man stone to pieces containing several tons. The contractor having failed to pave the abutment with concrete to the top of the bank, as was contemplated in the contract, was required in lieu thereof to cover the sloping bank with large rough stone of an average thickness of about 15 inches. On March 20 an extraordinary freshet occurred, reaching the top of the bank. While it had no material effect upon the lock and dam proper, nor yet upon the stone filling for protection of the bank below the abutment, nevertheless its effect upon both banks of the river, especially the right bank below the abutment, was marked by serious caving to a width of from 10 to 50 feet for a distance of nearly one-half mile. Two houses immediately below the abutment were undermined and slipped into the river after the freshet had subsided to a considerable extent, and one of the main buildings of the Heidenkamp Mirror Company was seriously undermined and that company's pumping plant destroyed. For the safety of the dam, the preservation of the navigable channel, and protection of property interests below the dam steps should be taken at once to protect the bank against further scour.

Under date of September 7, 1904, a contract was let to Gloster R. Merrill, of Tarentum, Pa., for the erection of a lock house at Lock No. 3. This house was under construction, being ready for plastering, at the time of the freshet of March 20. Owing to considerable scour along the outside foundation wall that wall was undermined, and with it the front veranda framework and floor were thrown into the river. Subsequently a supplemental agreement was entered into for restoring the foundation wall, veranda, etc., and at the end of the year these had been reconstructed and the structure practically completed.

The materials furnished and placed and work performed by contractor for the lock and dam during the year were as follows:

Embankment	cubic yards	160
Concrete	do	177
Stone paving of cribs	square yards	116
White-oak timber	feet B. M.	624,450
Hemlock timber	do	65,547
Riprap stone filling	cubic yards	8,520
Driftbolts, etc	pounds	93,204
Gravel filling	cubic yards	1,716
Backing of dam	do	6,700
Large stone below dam	do	903
Oak piles in place	number	654

E E 9.

OPERATING AND CARE OF LOCKS AND DAMS NOS. 1 AND 3, ALLEGHENY RIVER, PENNSYLVANIA.

A detailed statement of the operation of these locks and dams during the fiscal year ending June 30, 1905, will be found in the attached report of Assistant Engineer J. W. Arras.

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ALLOTMENT OF FUNDS.

January 9, 1903	[a]$9,610.00	February 10, 1905	[b]$3,000.00
July 20, 1903	[a]18,292.64	April 13, 1905	[b]6,000.00
July 22, 1904	[a]16,996.96		
November 21, 1904	[b]5,700.00	Total	59,599.60

Classified statement of expenditures incurred in operating and care of Locks and Dams Nos. 1 and 3, Allegheny River, for the fiscal year ending June 30, 1905.

Item.	Lock and Dam No. 1.	Lock and Dam No. 3.[a]	Total.
Salaries and wages for regular hired labor force	$10,953.81	$1,097.48	$12,050.79
Miscellaneous supplies and services	674.43	410.36	1,084.79
Miscellaneous repairs	2,462.54	1,348.93	3,811.47
Contingencies	863.00	9,425.89	10,288.89
Total	14,953.28	12,282.66	27,235.94

[a] From November 29, 1904, to end of fiscal year.

COMMERCIAL STATISTICS.

Traffic through Locks and Dams Nos. 1 and 3, Allegheny River, for the fiscal year 1905, as measured by the commerce through Lock and Dam No. 1, Allegheny River.

	Number.	Tons.[a]		Number.	Tons.[a]
Steamboats	4,737		Lath		237
Coal boats, barges, flats, etc	13,576		Lumber		18,426
Rafts	[2]		Poles, brace		2,000
Other craft	319		Posts, check, pit, etc		6,406
Barges, flats, etc. (new)		7,920	Sand		412,482
Bottoms, coal boat (new)		13,356	Stone		2,296
Coal		157,248	Ties, railroad		2,450
Farm products		700	Timber		41,886
General merchandise		558	Wood, cord		150
Gravel		563,664	Total		1,280,352
Iron products		573	Passengers	2,173	

[a] 2,000 pounds. Number of lockages, 3,663.

REPORT OF MR. J. W. ARRAS, ASSISTANT ENGINEER.

Lock and Dam No. 1.—During the year the various parts of this structure—lock, Chanoine wicket pass, and bear-trap weirs—have performed their functions acceptably in every particular. No difficulty was experienced in handling the commerce of the harbor through the lock or over the navigable pass of the dam. No accidents of any kind occurred to any of the shipping or to the structure or any property of the Government. The bear-trap gates were operated many times during the year, both for regulation of the pools above and below the dam, and for exhibition purposes, responding with the same facility and promptness as formerly.

In addition to operating the lock and dam and performing other routine work of a general nature, the regular force devoted considerable time to anchoring the upper courses of concrete in the lock walls by means of iron pins grouted into the walls to depths of 2 or 3 feet. Soundings taken above and below the dam showed no important or unusual changes or scour, except around the upper ends of the piers at the bear-trap weirs, where, owing to the frequent maneuvering of the gates and the tremendous velocity and force of the water through

[a] Lock and Dam No. 1. [b] Lock and Dam No. 3.

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the weirs, the gravel had scoured out to the bottom of the foundations of the piers. This was remedied by placing into the depression about 800 tons of large rough stone. Material scour also had occurred at the downstream extension wall of the abutment owing to the action of the water passing over the smaller bear-trap gate, threatening the destruction of such extension.

Commerce through the lock and over the dam shows a material increase of 164,120 tons over that of the preceding year.

At the beginning and end of the fiscal year the movable dam was up, and during the entire year was up forty days longer than in the preceding year. It was raised and lowered as follows:

Raised.	Lowered.	Days up.
	July 7, 1904	7
July 18, 1904	December 13, 1904	148
May 2, 1905	May 14, 1905	12
May 20, 1905	June 8, 1905	19
June 12, 1905	June 19, 1905	7
June 28, 1905		2
Total		195

Lock and Dam No. 3.—The lock was completed and put in operation September 29, 1904, and the structure assigned to operating and care of canals, etc., on November 29, 1904. Except when flooded or when the river was closed by ice the structure continued in service throughout the remainder of the fiscal year. The regular lock force, assisted by part of the force at Herr Island dam, installed the lock-operating devices, placed the angle plate along the upper corner of the dam, when completed by the contractor, and repaired the break at the abutment. They also removed a considerable quantity of gravel which had accumulated in the lock during its construction.

Three times during the winter the upper river disgorged its ice over the dam without causing damage to the physical structure. On March 9 the ice in the pool above the dam, which had attained to a thickness of about 2 feet, broke up and passed over the dam without damaging it. In breaking up, however, the ice gorged on the upper lock gates and return wall at head of the lock to an elevation of about 15 feet above the level of that structure. On the 18th there occurred a sudden freshet, due to the melting of the winter's accumulation of snow on the headwaters of the river, accompanied by considerable rainfall. When, on the following day, the stage of water had reached a height of 4 or 5 feet over the lock, owing to the presence of the ice dam at its head, the water at a high velocity passed diagonally across the lock, concentrating its force against the bank of the river at the end of the return crib at lower end of lock. This concentrated action of the water at the bank resulted in undermining the crib at its shore end, which, when partly undermined and considerably exposed along its upstream face, the ice dam at the head of the lock gave way, and rushing against the crib partially destroyed it. The gravel filling back of the lock wall having lost its support at the lower end, gradually began to scour out. On the 20th the water had reached its maximum height of 32.7 feet above low water. Three days later, when the water had fallen considerably, the embankment behind the lock wall washed out rapidly to a depth of about 10 feet up to the return wall at the head of the lock. Under the influence of a 4-foot head, water to a depth of 4 feet passing over the return wall quickly scoured to a depth of about 23 feet next to the lock, and at its shore end to such depth as to seriously endanger it. Prompt measures were taken to prevent the water from turning the end of the return wall, which was accomplished by depositing stone and other materials near by into the newly scoured channel between the wall and bank. In addition to such stone as could be secured near at hand, 14 carloads of stone were procured by rail and unloaded by the Pennsylvania Railroad Company. In all about 800 cubic yards of stone were placed immediately below and at the end of the return wall. After the rise had subsided the return crib, 12 feet by 12 feet by 90 feet in length, extending from the lower end of the lock to the bank, was reconstructed, filled with stone, and backed with large rough stone along the downstream edge. All of this was accomplished within about three weeks after the break occurred.

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The structure having been placed in a safe condition against future rises, arrangements were made with the Pennsylvania Railroad Company to restore the embankment behind the lock and guide walls by depositing waste furnace slag over the bank of the river from the head of the lock to a point about 500 feet below its downstream end. At the end of the year about 15,000 cubic yards of slag had been so placed along the bank, putting the same in a comparatively safe condition against future scour in the event of freshets.

When the March rise had subsided it was discovered that several hundred yards of gravel had been carried into the lock and banked against the upstream face of the lower lock gates. This condition put the lock out of service and also rendered it difficult to dredge the gravel, owing to the necessity of removing the gravel above one gate by hand in order to permit a dredge to enter. After six days' dredging operations the lock was emptied of gravel.

E E 10.

IMPROVEMENT OF ALLEGHENY RIVER, PENNSYLVANIA.

A description of the work done during the fiscal year ending June 30, 1905, will be found in the attached report of Assistant Engineer J. W. Arras.

Money statement.

July 1, 1904, balance unexpended	$6,822.94
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	1,819.26
July 1, 1905, balance unexpended	5,003.68
July 1, 1905, outstanding liabilities	3.00
July 1, 1905, balance available	5,000.68
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	15,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

APPROPRIATIONS.

March 3, 1879	$10,000	August 18, 1894	$12,500
June 14, 1880	20,000	June 3, 1896	12,500
March 3, 1881	25,000	March 3, 1899	15,000
August 2, 1882	15,000	August 17, 1900 (allotment)	5,000
July 5, 1884	35,000	June 13, 1902	10,000
August 5, 1886	30,000	June 13, 1902 (allotment)	5,000
August 11, 1888	25,000		
September 19, 1890	20,000	Total	265,000
July 13, 1892	25,000		

COMMERCIAL STATISTICS.

It is impracticable to obtain satisfactory information regarding the complete movements of commerce on the Allegheny River, since the trade is scattered over more than 350 miles of rivers and no systematic record of it is kept. The amount reported below is believed to be less than the actual tonnage.

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Articles.	Tons.[a]	Articles.	Tons.[a]
Barges (new)	9,000	Miscellaneous articles	2,279
Bark	180	Poles, brace	2,000
Bottoms, coal boat (new)	12,528	Posts, check, pit, etc	8,905
Brick	216	Sand	619,083
Coal	596,444	Stone	10,518
Farm products	1,025	Ties, railroad	3,500
General merchandise	411	Timber	100,317
Gravel	752,454	Wood, cord	150
Iron products, machinery, etc	1,163	Total	2,155,547
Lath	402		
Lumber	30,172		
Manure	4,800	Passengers.....number..	8,513

[a] 2,000 pounds.

REPORT OF MR. J. W. ARRAS, ASSISTANT ENGINEER.

The Allegheny River is navigable for floating craft not interfered with by low bridges, for a distance of about 275 miles, in the States of Pennsylvania and New York. However, the open-channel improvement of the stream has not usually been carried beyond the Pennsylvania and New York State line, 214 miles above the mouth of the river. Now that pool No. 3 of the slack-water system at the mouth of the stream has been established, open-channel operations are generally confined between the head of that pool, at Natrona, 25 miles above the mouth of the river, and the State line, or over a distance of 189 miles. This portion of the river has gradually been brought up to a satisfactory condition for the movement of small boats, barges, coal-boat bottoms, rafts, etc., so that at present a very small average annual expenditure is necessary to maintain it. The artificial improvements consist of low dikes and wing dams, and the principal work to be accomplished from year to year is their repair and the removal from bars and shoals of such bowlder and snag obstructions as are brought to light annually by freshets and ice gorges.

At the beginning of the fiscal year the artificial structures were all in serviceable condition and the channel comparatively free from serious obstructions. The following small repairs were made to dikes and dams:

Hickory dam.—This structure was built in 1891, and the exposed timbers show considerable decay. Eighty-two cross-ties were removed and the spaces paved with stone; 15 cubic yards of stone crib filling was put in place, and 190 square yards of stone paving placed.

Pithole dam.—This structure was also built in 1891. Thirteen cross-ties were taken out and the spaces paved with stone, and 32 square yards of crib paving replaced.

Red Bank dike.—This dike having been thoroughly overhauled in the season of 1902, remained in good condition. Slight repairs were made to the paving.

Cowanshannock dikes.—A small quantity of protection stone was placed about the pierhead of the upper dike.

Nicholsons Island dam.—Twenty-five cubic yards of large rough stone and 50 cubic yards of small stone, which had been moved from behind the middle timber wall by ice and freshets, were replaced and 32 cubic yards of gravel filled into the interstices. Also, 27 square yards of crib paving were restored.

Removal of obstructions.—On August 20 three small working parties, equipped for removing bowlders, snags, etc., commenced operations between Warren and the head of pool No. 3. They completed their work on November 30, having covered 165 miles of the river. The obstructions removed were 609 cubic yards of bowlders, 390 cubic yards of gravel, and 30 snags.

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E E 11.

LOCKS AND DAMS IN THE ALLEGHENY RIVER.

[Printed in House Document No. 167, Fifty-eighth Congress, third session.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, December 15, 1904.

SIR: 1. The river and harbor act of June 13, 1902, contained an item as follows:

Improving Allegheny River, Pennsylvania: Continuing improvement and for maintenance, ten thousand dollars.

The Secretary of War is authorized and directed to prosecute the work of constructing the dam at or near the head of Six Mile Island: *Provided*, That the expenditure shall not exceed the present limit of cost until further estimates shall have been submitted and said limit of cost extended by law.

2. At the time of the passage of this act there was before Congress a revised estimate of the cost of the three dams on the Allegheny River, which was printed as House Document No. 371, Fifty-seventh Congress, first session, but which was not adopted in any subsequent legislation.

3. The lock and dam at Herr Island has been finished, Lock and Dam No. 3 is complete with the exception of some details, and the lock at Sixmile Island (No. 2) is nearly finished.

4. Maj. W. L. Sibert, Corps of Engineers, the district engineer, submits the accompanying estimate of the work required to complete the project, with reasons for the increase in cost over the original estimate and that printed in the House document hereinbefore mentioned.

5. Dam No. 2 is the intermediate one of the series, and until it has been finished the benefit of the practical completion of Dam No. 3, next above, can not be realized.

6. The value of these improvements to the great interests bordering the Allegheny River is very great, and I am of the opinion that they should be pushed to completion.

7. The funds on hand are practically exhausted and without additional legislation the work can not proceed.

8. Understanding the wording of the river and harbor act of June 13, 1902, as permitting the submission of an estimate for completing the improvement, I have the honor to transmit for presentation to Congress the accompanying estimate.

Very respectfully,

A. MACKENZIE,
Brig. Gen., Chief of Engineers, U. S. Army.

Hon. WM. H. TAFT,
Secretary of War.

ESTIMATE FOR COMPLETING LOCKS AND DAMS NOS. 2 AND 3, ALLEGHENY RIVER, PENNSYLVANIA.

ENGINEER OFFICE, UNITED STATES ARMY,
Pittsburg, Pa., November 29, 1904.

GENERAL: * * * I have the honor to report that the estimate submitted by this office on January 21, 1902, for completing Locks and Dams Nos. 1 and 3 and for constructing Lock and Dam No. 2, Allegheny River, printed in Annual Report of the Chief of Engineers for 1902, is insufficient for the work contemplated.

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2. Locks 1 and 3 are now completed sufficiently to place them in operation, and the work done on them to date has cost—at Lock No. 1, $12,535.15, and at Lock No. 3, $11,037.53 in excess of estimate, and all of the work contemplated at both places is not completed.

3. The work yet to be done at Lock No. 2 is filling the lock grounds, building the houses and lock gates, and constructing the dam, the lock proper and abutment being practically complete. The estimate for building the dam, as submitted January 21, 1902, was based on unit prices for material in place that are very much less than such work can be procured for now. The unit prices in said estimate were based on prices for similar work at Herr Island Dam under contract with Hingston & Pihl, dated May 26, 1900, and for similar work at Dam No. 3, Allegheny River, under supplemental contract with Sloan, McIlvain & Ott Brothers, dated May 7, 1901. The unit prices on the above contracts for material in place such as that necessary for the great bulk of the work to be done January 21, 1902, were as follows:

Contract dated May 26, 1900:		
Excavation	per cubic yard	$0.30
Hemlock timber	per M feet B. M	$25.00 and 26.00
Oak timber	per M feet B. M	39.00
Driftbolts	per pound	.03
Screw bolts	do	.05
Stone filling	per cubic yard	$2.60 and 2.85
Stone, large	per cubic yard	3.10
Concrete	do	5.67
Piles	each	6.00
Supplemental contract dated May 7, 1901:		
Hemlock timber	per M feet B. M	27.50
Oak timber	do	40.00
Driftbolts	per pound	.03
Stone filling	per cubic yard	1.20
Stone, large	do	2.25
Gravel filling		.30

4. The prices for concrete in four contracts let on the Allegheny River prior to January, 1902, were as follows:

	Per cubic yard.
Sloan, McIlvain & Ott Bros., June 29, 1897, Lock No. 3	$5.57
Sloan, McIlvain & Ott Bros., June 29, 1897, Lock No. 2	4.99
W. W. Hegeman, September 7, 1898, Herr Island Dam	5.00
Hingston & Pihl, May 26, 1900, Herr Island Dam	5.67

5. Since January, 1902, large contracts have been entered into in this district in the near vicinity of Pittsburg at the following prices:

Material or work.	Designation.	Dam No. 5, Ohio River—Robert A. Cummings, Aug. 16, 1902.	Lock No. 2, Allegheny River—The Dravo Contracting Co., Dec. 31, 1902.	Davis Island dam, Ohio River—The Dravo Contracting Co., Oct. 17, 1903.	Dam No. 2, Ohio River—E. Brown Baker, Jan. 22, 1904.	Lock No. 2, Monongahela River—The Dravo Contracting Co., May 2, 1904.	Dam No. 4, Ohio River—Baker & Egan, Aug. 2, 1904.	Average prices.
Excavation	Cubic yards	$0.50	$1.10	$0.75	$0.90	$0.60	$0.80	$0.774
Hemlock lumber	M feet B. M	35.00	46.50	35.00	60.00	43.00	50.00	44.92
Oak lumber	do	70.00	62.00	60.00	65.00	54.00	85.00	66.00
Driftbolts, etc	Pounds	.04	.05		.04	.04	.05	.044
Stone filling	Cubic yards		3.10	3.00	3.00	2.50	3.00	2.92
Stone, large	do	3.50			3.50			3.50
Gravel filling	do	.50	1.10	.75	.40		.60	.67
Sheet piles	M feet B. M	50.00	62.00	70.00	70.00	55.00	90.00	66.17
Concrete	Cubic yards	7.50	7.10	7.70	7.25	5.50	6.00	6.84
Piles	Number					6.00		6.00

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6. Applying the foregoing average prices to the estimated quantities in estimate of January 21, 1902, the cost of the dam at Lock No. 2, Allegheny River, will be $281,226.63. This dam is about 1,250 feet long, and the dredging for its foundation will be difficult on account of the shallowness of the site. The dam, as at present planned, is to be a timber dam. Should the cost, however, be as much as that stated above, a concrete dam would be materially cheaper. It is estimated that a concrete dam, or rather a dam with a pile and timber substructure and a concrete top, at this place would cost $203,591.50. (For detailed estimate see items under "Dam"—"Lock and Dam at Six-Mile Island (No. 2)"—in table following.) The United States is now building a dam of this type at Lock No. 2, Monongahela River, and it is considered preferable to an all-timber dam, principally on account of less needed repairs and, considering present prices, on account of the cost. The sudden jump in prices for timber in place, and stone, and dredging in this district of nearly 100 per cent has rendered it impossible to build within the estimate some of the works undertaken a good many years ago, and this material increase was unfortunately not foreseen in the estimate submitted January 21, 1902, for completing Locks and Dams Nos. 1 and 3 and for constructing Lock and Dam No. 2, Allegheny River.

7. I have, therefore, to submit the following as a new estimate for completing Locks and Dams Nos. 2 and 3, Allegheny River:

Lock and dam at Sixmile Island (No. 2).

Lock:		
Fill back of lock, 30,000 cubic yards, at 30 cents	$9,000.00	
Fill for lock houses, 8,100 cubic yards, at 30 cents	2,430.00	
Paving back of lock, 2,000 square yards, at $2	4,000.00	
Two lock houses	9,000.00	
Lock gates and gate-operating devices	13,000.00	
		$37,430.00
Dam:		
Excavation, 28,000 cubic yards, at 50 cents	14,000.00	
Hemlock timber, 370,000 feet B. M., at $45	16,650.00	
Oak timber, 445,000 feet B. M., at $55	24,475.00	
Sheet piling, 180,000 feet B. M., at $80	14,400.00	
Driftbolts, 80,000 pounds, at 5 cents	4,000.00	
Piles, 1,872, at $7 each	13,104.00	
Riprap stone filling, 13,725 cubic yards, at $2.50	34,312.50	
Large stone, 2,260 cubic yards, at $3.50	7,910.00	
Gravel back fill, 7,000 cubic yards, at 50 cents	3,500.00	
Concrete, 8,905 cubic yards, at $8	71,240.00	
		203,591.50

Lock and dam at Springdale (No. 3).

One lock house	3,500.00	
Fill for lock houses, 4,000 cubic yards, at 25 cents	1,000.00	
Paving back of lock, 2,000 square yards, at $1.50	3,000.00	
		7,500.00
		248,521.50
Engineering and superintendence		8,000.00
Total		256,521.50

This estimate does not include channel dredging, the greater portion of which, it is hoped, will be done by the sand boats operating under permits.

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8. The balance available October 31, 1904, was $3,351.90.

Very respectfully, your obedient servant,

WM. L. SIBERT,
Major, Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.
(Through the Division Engineer.)

[First indorsement.]

ENGINEER OFFICE, U. S. ARMY, CENTRAL DIVISION,
Detroit, Mich., December 5, 1904.

1. Respectfully forwarded to the Chief of Engineers, United States Army.

2. I concur with Major Sibert, that it is advisable to build the dam for Lock No. 2, Allegheny River, of the same type as that now being built for No. 2, Monongahela River, rather than adhere to the all-timber type originally contemplated, and I recommend approval of the new estimates submitted within for completing Locks and Dams Nos. 2 and 3, Allegheny River.

G. J. LYDECKER,
Colonel, Corps of Engineers,
Division Engineer, Central Division.

E E 12.

ESTABLISHMENT OF HARBOR LINES ON MONONGAHELA RIVER FROM McKEESPORT TO WILSON, PITTSBURG HARBOR, PENNSYLVANIA.

PITTSBURGH STEEL FOUNDRY,
Pittsburg, Pa., December 5, 1902.

SIR: As property holders on the Monongahela River at Glassport, we are desirous of having the harbor lines established, and we respectfully petition that steps be taken to that end.

Yours, respectfully,

PITTSBURGH STEEL FOUNDRY,
STEWART JOHNSON, *President.*

Hon. ELIHU ROOT,
Secretary of War.

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
December 10, 1902.

Respectfully referred to Capt. W. L. Sibert, Corps of Engineers, for report, attention being invited to previous correspondence on this subject herewith.

To be returned.

By command of Brig. Gen. Gillespie:

A. MACKENZIE,
Colonel, Corps of Engineers.

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[Third indorsement.]

U. S. ENGINEER OFFICE,
Pittsburg, Pa., December 24, 1902.

Respectfully returned to the Chief of Engineers, United States Army.

That part of the Monongahela River on which an establishment of harbor lines is requested herein extends from Wilson to Otto, 2¼ miles, the lower end being about 18 miles above the mouth.

A harbor line along the right bank was laid down on the maps furnished with this application, and was recommended for establishment by Maj. Chas. F. Powell, Corps of Engineers, in report dated February 2, 1901, but after a public hearing and further consideration, which developed dissatisfaction on the part of some of the riparian owners with the line proposed by Major Powell, it was decided not advisable to establish a harbor line there at that time.

The upper end of this reach joins the section, Wilson to Elizabeth, 2.9 miles long, where harbor lines were recently laid down and recommended for establishment in my report dated November 7, 1902. * * * The lower end is only 1.9 miles above the end of the present established Pittsburg Harbor lines at McKeesport, making a gap of 4.1 miles between the upper end of present established lines and the lower end of reach where lines have been laid down and recomended for establishment.

It is, in the opinion of this office, essential that harbor lines be established, not only in the reach specified in this application, but in the reach connecting the proposed reach with the upper end of the established harbor lines at McKeesport. It is essential that manufacturing establishments along the banks of the reach in question know lines beyond which no piers, wharves, etc., can be constructed. It is essential to the Government that such lines be established and marked, thus enabling the United States agents to better detect and prevent violation of the laws against encroachment on the navigable capacity of the river. It is impracticable to patrol the banks of the Monongahela River for 30 or 40 miles and detect all encroachments upon the navigable capacity of the stream unless the stream be definitely marked.

The maps[a] accompanying the present application, covering 2¼ miles, Wilson to Otto, and others obtainable from existing Government and private surveys covering the 1.9 miles from Otto to McKeesport are sufficiently accurate for establishing harbor lines, and the small additional expense for maintenance can be paid from allotment for operating and care of Monongahela River.

It is respectfully recommended that this office be authorized to undertake, in the usual way, the establishment of harbor lines on both sides of the Monongahela River from McKeesport to Wilson, 4.1 miles. This reach includes the reach referred to in application.

WM. L. SIBERT,
Captain, Corps of Engineers.

[a] Not printed.

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[Fourth indorsement.]

OFFICE OF THE CHIEF OF ENGINEERS, U. S. ARMY,
January 7, 1903.

Respectfully returned to Captain Sibert.

The recommendation contained in paragraph 6 of the preceding indorsement is approved.

After the matter has been carefully investigated and tentative lines have been drawn upon a convenient map the whole subject will be considered at a public hearing, previously advertised, at which all interested parties will be given full opportunity to examine the proposed lines and express their views thereupon.

With his final report on the proposed lines Captain Sibert will submit a tracing showing the lines, with proper description, which, in his opinion, will best subserve the various interests involved.

In this connection attention is invited to the fact that the matter of the establishment of harbor lines, especially in growing industrial centers, is one which should be treated with great care. The lines to be approved should be so marked and described that their location at any point may be determined with precision and without unusual difficulty, and the monuments to which they are referred should be such as are not likely to be disturbed by ordinary changes. Furthermore, the lines should be so fixed with regard to present and future land and water interests that the necessity for future modifications may be obviated so far as possible, and thus reduce to a minimum the likelihood of embarrassing controversies arising, in which the rights of property and the efficiency of the work of the Department may be brought in question.

To be returned.

By command of Brig. Gen. Gillespie:

A. MACKENZIE,
Colonel, Corps of Engineers.

[Fifth indorsement.]

U. S. ENGINEER OFFICE,
Pittsburg, Pa., April 2, 1904.

Respectfully returned to the Chief of Engineers, United States Army.

The portion of the Monongahela River under consideration, viz, McKeesport to Wilson, 4.1 miles, was accurately mapped on four sheets, using the data referred to in paragraph 5 of third indorsement and some additional locations, all based on a triangulation system surveyed under my direction in 1902.

Tentative harbor lines were laid down on these sheets, following principles adopted when locating the harbor lines in the adjoining reach, from Wilson to Elizabeth, established February 3, 1903; that is, the shore line at pool full was first averaged by a regular line drawn on the map. The harbor lines were placed generally 42 feet landward of this averaged low-water line, and the elevation of such lines was made to correspond approximately with that of the Pittsburg harbor lines established in 1895, viz, 14 feet above pool-full surface, at the top of a slope of 1 on 3 toward the river. This brings

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the foot, at pool full of the new bank slope generally to the average of the present pool-full shore line, which arrangement is considered best, as it preserves low-water widths, does not unduly contract the high-water widths, and the new bank comes within reasonable distance of the water for landing and other purposes. Exceptions to this general rule were made at a few places where deemed advisable, in cases of a wide, low beach, or of a very narrow beach at foot of steep bank, or to give a better shape to the new bank line.

On February 16, 1904, notices of a public hearing to be held March 15, 1904, for consideration of the proposed harbor lines were sent to all parties interested, as shown on copy herewith and list attached (Exhibit A).[a] Formal advertisement of the hearing was also made in the four Pittsburg newspapers, and the matter was mentioned as local news in these and other papers. The circular notice of the hearing was posted in post-offices of the locality.

At a public hearing, record of which is forwarded herewith (Exhibit E),[a] the few objections made were all withdrawn after a better understanding of the conditions by property owners and after slightly changing the proposed locations in two instances. It is believed the lines as now proposed are acceptable to all persons interested.

The establishment of harbor lines in this reach of the river being essential to the preservation and protection of the harbor, and the proposed locations being such as, in the opinion of this office, will best accomplish the above object, it is respectfully recommended that the harbor lines as shown and described on the accompanying five sheets (Nos. 29 to 32, and title sheet),[a] Monongahela River, McKeesport to Wilson, Pa., be approved by the Secretary of War.

WM. L. SIBERT,
Captain, Corps of Engineers.

[Eighth indorsement.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, July 5, 1904.

Respectfully returned to the Secretary of War.

Request is made for the establishment of harbor lines on the Monongahela River at Glassport, Pa.

A similar request was submitted to the Department in February, 1901. Although the establishment of such lines was deemed desirable, nevertheless, in view of the difficulty of determining upon lines that would be acceptable to all interests involved, the Secretary of War, upon the recommendation of this office, decided that it was not advisable at that time to establish harbor lines at the locality in question.

In consequence of the present application, the matter has been taken up anew and given most careful consideration. Tentative lines covering the stretch of river from McKeesport to Wilson, to connect with harbor lines both above and below, were laid down for discussion at a duly advertised public hearing, and these lines, after a few slight changes, are reported to be acceptable to all persons interested.

[a] Not printed.

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In the opinion of the local engineer officer, Major Sibert, the establishment of harbor lines is essential to the preservation and protection of this reach of river, which forms a part of Pittsburg Harbor, and the lines as finally determined by him are those which will best accomplish that object.

Concurring in the views of the district officer, I recommend that the harbor lines for both banks of the Monongahela River from McKeesport to Wilson, Pa., as delineated and described on the accompanying tracings,[a] be approved by the Secretary of War, and also that the Secretary place his approval upon the title and index sheet, which has been prepared for his signature.

A. MACKENZIE,
Brig. Gen., Chief of Engineers, U. S. Army.

[Ninth indorsement.]

WAR DEPARTMENT, *July 7, 1904.*

Approved as recommended by the Chief of Engineers.

ROBERT SHAW OLIVER,
Acting Secretary of War.

E E 13.

MODIFICATION OF HARBOR LINES IN MONONGAHELA RIVER AT LOCK NO. 2, PITTSBURG HARBOR, PENNSYLVANIA.

ENGINEER OFFICE, UNITED STATES ARMY,
Pittsburg, Pa., November 30, 1904.

GENERAL: I have the honor to forward herewith tracing showing a modification of harbor line at Lock No. 2, Monongahela River, which is proposed in the public interest.

When the new Lock and Dam No. 2, now being constructed about one-half mile below the present Lock No. 2, is completed and the old lock is removed, a gap about 770 feet long, now fronted by the present lock property, will be left uncovered by a harbor line. The removal of the lock also cancels the necessity for the vertical bank as now provided along the harbor lines approaching the lock.

The recent reconstruction of the railroad bridge next below the lock, increasing the length of the channel span from 260 feet to 409 feet, permits a slight advance of the bank on river side of the right channel pier, thus preventing danger of boats striking the pier at any stage of river.

The modification, as shown by heavy broken black line on tracing herewith, forms a reasonable connection between parts of the harbor line now separated and is recommended for approval, with the reservation that this modification shall become effective when the construction of new Lock and Dam No. 2 renders the site of the present lock useless to the United States.

Very respectfully, your obedient servant,

WM. L. SIBERT,
Major, Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.,
Washington, D. C.

---

[a] Not printed.

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[1st Indorsement.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, February 9, 1905.

Respectfully submitted to the Secretary of War with recommendation that, for the reasons given within, the modified harbor line proposed by Major Sibert for the right bank of the Monongahela River at Lock No. 2, at Port Perry, Pa., be approved, with the reservation that this modification shall become effective when the construction of new Lock and Dam No. 2 shall render the site of the present lock useless to the United States.

The map[a] showing the modification has been prepared for the signature of the Secretary of War.

This modification of harbor line at this point is also an essential feature of the agreement entered into under date of June 30, 1904, between the Acting Secretary of War and Messrs. John F. Miller and John R. McGinley, by which certain property rights were released and quitclaimed to Messrs. Miller and McGinley in consideration of a release and waiver of the obligation now resting upon the United States to furnish surplus water created by the present Dam No. 2.

A. MACKENZIE,
Brig. Gen., Chief of Engineers, U. S. Army.

NOTE.—The lines referred to above and shown on the map mentioned were approved by the Assistant Secretary of War February 10, 1905, the approval being noted on the map.

[a] Not printed.

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APPENDIX F F.

CONSTRUCTION OF LOCKS AND MOVABLE DAMS IN OHIO RIVER BETWEEN THE PENNSYLVANIA STATE LINE AND CINCINNATI, OHIO, AND IMPROVEMENT OF KANAWHA AND LITTLE KANAWHA RIVERS, WEST VIRGINIA.

REPORT OF MAJ. GEO. A. ZINN, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1905, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Movable dams in Ohio River.
2. Little Kanawha River, West Virginia.
3. Operating and care of lock and dam on Little Kanawha River, West Virginia.
4. Kanawha River, West Virginia.
5. Operating and care of locks and dams on Kanawha River, West Virginia.

UNITED STATES ENGINEER OFFICE,
Wheeling, W. Va., July 19, 1905.

GENERAL: I have the honor to transmit herewith the annual report of the works under my charge for the fiscal year ending June 30, 1905,

The following assistant employees were in local charge of the works:

William M. Hall, assistant engineer, Dams Nos. 18 and 19, Ohio River and Little Kanawha River; Thomas E. Jeffries, assistant engineer, Kanawha River; William A. Christian, assistant engineer, Dam No. 8, Ohio River; Frank D. Holbrook, junior engineer, Dam No. 11, Ohio River, and George S. Patrick, inspector, Dam No. 13, Ohio River.

Very respectfully, your obedient servant,

GEO. A. ZINN,
Major, Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

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F F 1.

MOVABLE DAMS IN OHIO RIVER BETWEEN THE PENNSYLVANIA STATE LINE AND CINCINNATI.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1905.

Dam No. 8, about 46 miles below Pittsburg, Pa.—On July 25 construction work was commenced by The T. A. Gillespie Company, of Pittsburg, Pa., on the lock and guide walls. Excavation was made and sheet and round piles driven for foundation for upper guide wall (a distance of 600 feet). A layer of concrete 2 feet thick was placed on the piles and the wall completed for 240 linear feet. Part of the riprap protection was also placed along this wall. Excavation was partially made for the foundations for lock walls and gate recesses and for the lock-chamber floor. Some sheet and round piles were driven for the upper gate-track and river-wall foundations, and the placing of concrete for the gate-track foundation begun. During the winter months the contractor built a pile cofferdam inclosing the entire area at the proposed lock.

The following are the quantities of material placed and excavated:

Sheet piles	linear feet	18,886.5
Round piles	do	21,467.0
Concrete	cubic yards	2,531.19
Stone filling	do	550.0
Iron and steel	pounds	5,057.5
Timber	feet B. M.	4,684.0
Cast-iron pipe	linear feet	19.5
Excavation	cubic yards	87,830.0

The temporary building to be used as an office was completed and the government land at this site marked with concrete monuments.

Dam No. 11, about 77 miles below Pittsburg, Pa.—The contract entered into June 30, 1904, with the Ætna Construction Company, of Wheeling, W. Va., having received the approval of the Department, the construction of the lock and guide walls was commenced on July 17. Work was confined to the land wall, lower gate recess, and upper guide wall. Considerable filling taken from the excavations made for land-wall, gate-recess, and upper guide-wall foundations was placed in the lock yard. The lower gate recess and foundation for land wall are well under way. During the year the following work was accomplished:

Grubbing and clearing	acre	1.00
Timber	feet B. M.	1,934.00
Sheet piles	linear feet	19,340.92
Round piles	do	9,652.90
Filling	cubic yards	17,935.00
Excavation	do	32,339.00
Concrete	do	3,412.84
Iron and steel	pounds	3,595.75
Cast-iron pipe	linear feet	47.00

The final piece of land required at this site was purchased and all government land marked with concrete monuments.

Dam No. 13, about 96 miles below Pittsburg, Pa.—Work on the lock (walls) being well advanced, plans for the dam, except superstructure of bear traps, were prepared and forwarded to the Department for approval. Plans for a power house and for lock houses

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were also prepared. A contract was entered into with the Atlas Portland Cement Company, of New York, for furnishing the Portland cement required to complete the lock. During the year 9,200 barrels of Portland and 7,200 barrels of natural cement were received. The purchase of the additional land necessary at this site was practically concluded at the close of the year.

The progress made by The Sheridan-Kirk Contract Company, contractors for building the masonry of lock, was very unsatisfactory, and it was necessary to grant the company an extension of time in which to complete the work. No effort was made to take advantage of the favorable conditions which prevailed during the fall months, the force employed being entirely inadequate. A statement of the work accomplished during the year follows:

Deposit excavation	cubic yards	2,394.00
Excavation	do	28,214.17
Filling	do	10,433.80
Concrete	do	14,075.43
Timber	feet B. M.	22,691.97
Sheet piles	linear feet	13,577.10
Round piles	number	65.00
Iron and steel	pounds	91,491.26
Iron pipe	linear feet	76.00

Six hundred and forty linear feet of the land wall, the upper gate recess and track, and 75 per cent of the lower gate recess, and the driving of sheet piles for the foundation for the track were completed.

Dam No. 18, about 179 miles below Pittsburg, Pa.—Plans for the dam, except superstructure of bear traps, with and without service bridge, were prepared and proposals solicited. The cost of a dam with a service bridge, as shown by the proposals received, was so much greater than a dam without a service bridge that it was doubtful if the advantages of the service bridge would justify the cost, and the plans for a dam without service bridge were adopted. Plans for lock gates and machinery and for the bear traps (superstructure) are in preparation. The Atlas Portland Cement Company furnished 12,918 barrels of Portland cement for use in the construction of the lock.

With the exception of filling, grading, and paving the lock yard, The Evansville Contract Company (trustees) completed its contract for building lock and guide walls. As the contract was not completed within the time limit, an extension was granted. The following work was accomplished during the year:

Filling	cubic yards	46,716.0
Puddling	do	1,055.0
Stone filling	do	2,338.0
Excavation	do	4,828.0
Rock excavation	do	7,683.9
Concrete	do	12,836.0
Oak timber	feet B. M.	10,380.0
Paving	cubic yards	1,720.0
Bolt holes	linear feet	256.0
Iron and steel	pounds	64,121.0
Vitrified pipe	linear feet	563.0
Iron pipe	do	4,582.0

A contract was entered into May 18, 1905, with the Baker Contract Company (Incorporated), of Pittsburg, Pa., for the construction of

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the dam, the Government to furnish the cement and material necessary for constructing the superstructure of the two bear traps. Work under this contract was commenced June 1, but high water interfered with its progress. Five thousand four hundred and eighty cubic yards of material was removed for the pass and abutment foundations.

Proposals were received for cement required for the construction of the dam, but award was not made.

Dam No. 19, about 191 miles below Pittsburg, Pa.—The final piece of land required for this site was purchased, and all of the government land marked with concrete monuments. In accordance with the provision contained in the river and harbor act of March 3, 1905, operations have been suspended.

Dam No. 26.—While the river and harbor act of March 3, 1905, makes an appropriation for the purchase of site for Lock and Dam No. 26, it is provisional on the outcome of an examination and report called for by the same act. No work was done.

Attention is invited to the recommendations contained in the Annual Reports of the Chief of Engineers for 1903 and 1904, pages 1714 and 2568, respectively, in regard to the manner in which work on the Ohio River should be conducted to obtain the best results.

From the latter part of July until the first of December of 1904 the weather conditions and stage of water were most favorable for construction work on the Ohio River. While fair progress was made by the contractors having locks under construction in this district, it is not believed that the work was hurried along as it should have been. Whether the construction of locks and dams on this river can be done more economically and in less time by hired labor, experience alone can decide; but it is confidently believed that more satisfactory structures will be obtained if thus built. The character of the material forming the river bed being very difficult to determine definitely, it is almost impossible to prepare plans for the foundations which do not require changes to meet unlooked-for conditions. Such changes can be easily met when the work is being carried on by hired labor, but when under contract it is likely to involve delay, undue extra cost, and disagreement.

Money statements.

DAM NO. 8.

July 1, 1904, balance unexpended	$270,443.84
Amount appropriated by river and harbor act approved March 3, 1905	80,000.00
	350,443.84
June 30, 1905, amount expended during fiscal year, for works of improvement	69,947.75
July 1, 1905, balance unexpended	280,496.09
July 1, 1905, outstanding liabilities	563.85
July 1, 1905, balance available	[a]279,932.24
July 1, 1905, amount covered by uncompleted contracts	192,610.58
Amount (estimated) required for completion of existing project	470,000.00

[a] $80,000 to be applied to existing contract.

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Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	$200,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

DAM NO. 11.

July 1, 1904, balance unexpended	$269,178.41
Amount appropriated by river and harbor act approved March 3, 1905	80,000.00
	349,178.41
June 30, 1905, amount expended during fiscal year, for works of improvement	56,975.64
July 1, 1905, balance unexpended	292,202.77
July 1, 1905, outstanding liabilities	283.39
July 1, 1905, balance available	[a]291,919.38
July 1, 1905, amount covered by uncompleted contracts	201,947.29
Amount (estimated) required for completion of existing project	470,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	200,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

DAM NO. 13.

July 1, 1904, balance unexpended	$390,844.48
Amount appropriated by sundry civil act approved March 3, 1905	50,000.00
	440,844.48
June 30, 1905, amount expended during fiscal year, for works of improvement	109,054.73
July 1, 1905, balance unexpended	331,789.75
July 1, 1905, outstanding liabilities	5,729.98
July 1, 1905, balance available	326,059.77
July 1, 1905, amount covered by uncompleted contracts	146,474.96
Amount (estimated) required for completion of existing project	223,400.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	223,400.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

DAM NO. 18.

July 1, 1904, balance unexpended	$390,001.85
Amount appropriated by sundry civil act approved March 3, 1905	50,000.00
	440,001.85
June 30, 1905, amount expended during fiscal year, for works of improvement	125,293.55
July 1, 1905, balance unexpended	314,708.30
July 1, 1905, outstanding liabilities	1,066.59
July 1, 1905, balance available	313,641.71

[a] $80,000 to be applied to existing contract.

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July 1, 1905, amount covered by uncompleted contracts	$254,835.52
Amount (estimated) required for completion of existing project	270,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	270,000.00

DAM NO. 19.

July 1, 1904, balance unexpended	$8,554.02
Amount appropriated by river and harbor act approved March 3, 1905	100,000.00
	108,554.02
June 30, 1905, amount expended during fiscal year, for works of improvement	565.66
July 1, 1905, balance unexpended	107,988.36
Amount (estimated) required for completion of existing project	825,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	300,000.00

DAM NO. 26.

Amount appropriated by river and harbor act approved March 3, 1905	$35,000.00
July 1, 1905, balance unexpended	35,000.00

APPROPRIATIONS.

March 3, 1899:	
Construction of Dam No. 13	$50,000
Construction of Dam No. 18	50,000
June 6, 1900, continuing construction of Dams Nos. 13 and 18	470,000
March 3, 1901, continuing construction of Dams Nos. 13 and 18	40,000
June 13, 1902:	
Construction of Lock and Dam No. 8	50,000
Construction of Lock and Dam No. 11	50,000
Construction of Lock and Dam No. 19	25,000
June 28, 1902, continuing construction of Dams Nos. 13 and 18	46,600
March 3, 1903:	
Continuing construction of lock at Dam No. 8	200,000
Continuing construction of lock at Dam No. 11	200,000
Continuing construction of Dams Nos. 13 and 18	450,000
April 28, 1904:	
Continuing construction of Dam No. 8	50,000
Continuing construction of Dam No. 11	50,000
March 3, 1905:	
Completion of locks at Dams Nos. 8 and 11	160,000
Continuing construction of Dams Nos. 13 and 18	100,000
Construction of Lock and Dam No. 19	100,000
Purchase of site for Lock and Dam No. 26	35,000
Total	2,126,600

ABSTRACT OF CONTRACTS IN FORCE FOR IMPROVING OHIO RIVER BELOW PITTSBURG, PA.

Lock for movable Dam No. 8.

Contractor: The T. A. Gillespie Company.

Rate: Grubbing and clearing at $100 per acre; timber, $35 per thousand; sheet piling, 50 cents per linear foot; round piling, 41 cents per linear foot;

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common filling, 30 cents per cubic yard; stone filling, $2 per cubic yard; stone steps, $1.25 per linear foot; common excavation, 50 cents per cubic yard; concrete, $5.95 per cubic yard; white-oak timber, $60 per thousand; paving, $6 per cubic yard; bolt holes, $1 per linear foot; iron and steel, 6 cents per pound; cast-iron pipe, 6-inch, $1.50 per linear foot; galvanized-iron pipe, 3-inch, $1 per linear foot; galvanized-iron pipe, 1½-inch, 60 cents per linear foot.

Date of approval: June 24, 1904.
Date of beginning: July 27, 1904.
Date of expiration: 210 fair working days.

Lock for movable Dam No. 11.

Contractor: Ætna Construction Company.
Rate: Grubbing and clearing at $200 per acre; timber $40 per thousand; sheet piling, 50 cents per linear foot; round piling, 40 cents per linear foot; common filling, 30 cents per cubic yard; stone filling, $2.50 per cubic yard; stone steps, $1 per linear foot; common excavation, 65 cents per cubic yard; concrete, $5.35 per cubic yard; white-oak timber, $60 per thousand; paving, $5 per cubic yard; bolt holes, 50 cents per linear foot; iron and steel, 5 cents per pound; cast-iron pipe, 6-inch, $2 per linear foot; galvanized-iron pipe, 3-inch, $1 per linear foot; galvanized-iron pipe, 1½-inch, 40 cents per linear foot.
Date of approval: July 11, 1904.
Date of beginning: August 11, 1904.
Date of expiration: 210 fair working days.

Lock for movable Dam No. 13.

Contractor: The Sheridan-Kirk Contract Company.
Rate: Cofferdam at $10 per linear foot; temporary piling, 35 cents per linear foot; sheet piling, 35 cents per linear foot; ordinary excavation, 30 cents per cubic yard; deposit excavation, 50 cents per cubic yard; channel dredging, 25 cents per cubic yard; rock excavation, $3 per cubic yard; ordinary filling, 30 cents per cubic yard; stone filling, $3 per cubic yard; special ashlar masonry, $16 per cubic yard; coping masonry, $17 per cubic yard; rubble masonry, $5.50 per cubic yard; brick masonry, $11 per cubic yard; concrete masonry (cement furnished by United States), $2.85 per cubic yard; oak timber, $50 per thousand; hemlock timber, $35 per thousand; cast iron, 5 cents per pound; wrought iron, 5 cents per pound; steel, 5 cents per pound; iron pipe, 3-inch, 15 cents per linear foot.
Date of approval: July 5, 1901.
Date of beginning: September 7, 1901.
Date of expiration: 400 fair working days. (Time limit waived.)

Natural cement at Dam No. 13.

Contractors: L. S. McKallip & Co.
Rate: In paper bags at 81 cents per barrel.
Date of approval: July 29, 1901.
Date of beginning: When notified.
Date of expiration: December 31, 1902, or on completion of construction work.

Portland cement for Dam No. 13.

Contractor: Atlas Portland Cement Company.
Rate: In paper bags at $1.32 per barrel.
Date of approval: April 6, 1905.
Date of beginning: When notified.
Date of expiration: December 31, 1905.

Lock for movable Dam No. 18.

Contractor: The Evansville Contract Company.
Rate: Grubbing and clearing at $25 per acre; hemlock timber and plank, $40 per thousand; sheet piling, $45 per thousand; round timber, 25 cents per linear foot; round piling, 30 cents per linear foot; common filling, 27 cents per cubic yard; puddling, $2 per cubic yard; stone filling, $1.50 per cubic yard; common

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excavation, 25 cents per cubic yard; rock excavation, $2.50 per cubic yard; concrete (cement furnished by United States), $4 per cubic yard; oak timber, $50 per thousand; paving, $3.50 per cubic yard; curbing, $7 per cubic yard; bolt holes, 50 cents per linear foot; iron and steel, 5½ cents per pound; vitrified pipe, 8-inch, 35 cents per linear foot; vitrified pipe, 12-inch, 50 cents per linear foot; galvanized-iron pipe, 3-inch, 60 cents per linear foot; galvanized-iron pipe, 2-inch, 40 cents per linear foot; galvanized-iron pipe, 1½-inch, 40 cents per linear foot; highway, 50 cents per square yard.

Date of approval: December 10, 1902.

Date of beginning: January 14, 1903.

Date of expiration: 300 fair working days. (Time limit waived.)

Movable Dam No. 18.

Contractor: Baker Contract Company (Incorporated).

Rate: Common excavation at 70 cents per cubic yard; rock excavation, $3 per cubic yard; common filling, 70 cents per cubic yard; stone filling, $3 per cubic yard; timber, $60 per thousand; white-oak timber, $80 per thousand; yellow-pine timber, $70 per thousand; iron and steel, 7 cents per pound; reenforcing steel, 6 cents per pound; concrete, $6 per cubic yard; paving, $6 per cubic yard; curbing, $1 per linear foot; bolt holes in masonry, 2-inch or less diameter, 50 cents per linear foot; bolt holes in masonry, more than 2-inch diameter, 75 cents per linear foot; galvanized-iron pipe, 1½-inch, 50 cents per linear foot; galvanized-iron pipe, 3-inch, 75 cents per linear foot; galvanized-iron pipe, 4-inch, $1 per linear foot.

Date of approval: June 3, 1905.

Date of beginning: July 5, 1905.

Date of expiration: 300 fair working days.

COMMERCIAL STATISTICS.

Freight handled at the wharves of some of the principal cities between Dam No. 8, Ohio River, and Ripley, Ohio, during the calendar year 1904.

Name of city.	Freight.	Passengers.	Name of city.	Freight.	Passengers.
	Tons.	*Number.*		*Tons.*	*Number.*
East Liverpool, Ohio	45,500	8,000	Middleport, Ohio	800	1,200
Wellsville, Ohio	200	500	Point Pleasant, W. Va.	8,500	7,000
Steubenville, Ohio	12,700	10,300	Catlettsburg, Ky	10,000	5,000
Wheeling, W. Va.	130,000	60,000	Ashland, Ky	1,000,000	
Moundsville, W. Va.	50,000	30,850	Ironton, Ohio	10,500	14,700
Marietta, Ohio	22,520	34,370	Portsmouth, Ohio	1,250,000	18,000
Ravenswood, W. Va.	20,000	500	Ripley, Ohio	60,000	

The number of passengers includes excursionists.

The information contained in the foregoing table was obtained through the mayors of the several cities mentioned. It appears that no accurate record is kept of tonnage and passenger traffic at most of the towns on the Ohio River, and the quantities given in the above table are only approximately correct.

F F 2.

IMPROVEMENT OF LITTLE KANAWHA RIVER, WEST VIRGINIA.

Owing to the small amount available for removing obstructions, no work was accomplished during the low-water season of the past year except the removal of a sunken barge just below Creston, W. Va.

During the construction of a railroad along the river banks the contractors caused a large number of stones to be thrown into the

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river, which proved obstructions. These stones were removed under the direction of a government inspector.

Structures, etc., completed under permits from the War Department were inspected to ascertain whether or not the requirements of the permits were complied with.

The river and harbor act of March 3, 1905, provided $1.000 for maintenance. Preparations were in progress at the close of the fiscal year for the removal of obstructions.

Five hundred dollars can be profitably expended on this river each year in removing obstructions and in maintaining the channel, but to remove the large obstructions which seriously interfere with navigation will require about $10,000.

The commercial statistics for the upper section of the river are contained in the report for operating and care of lock and dam on Little Kanawha River, West Virginia.

In addition to the amount for maintenance, the above-mentioned act contains the following:

Improving Little Kanawha River, West Virginia, in accordance with the report submitted in House Document Numbered Three hundred and nine, Fifty-eighth Congress, second session, one hundred and sixty-three thousand dollars: *Provided*, That no part of said amount shall be expended unless the franchises and improvements in said river belonging to the Little Kanawha Navigation Company can be purchased, and a complete and satisfactory title vested in the United States, at a cost not exceeding seventy-five thousand dollars, to be paid from the amount herein appropriated.

Although officially notified, the Little Kanawha Navigation Company has not yet signified its willingness to accept the amount mentioned in the act. It is believed, however, that a movement is in progress to harmonize the interests of the stock and bond holders so as to transfer the company's property to the United States at an early date.

On July 14, 1905, a resolution was passed by the stockholders of the Little Kanawha Navigation Company directing the transfer of its property on the Little Kanawha River to the United States Government for the sum of $75,000.

Money statements.

ABOVE LOCK NO. 5.

July 1, 1904, balance unexpended		$281.35
Amount appropriated by river and harbor act approved March 3, 1905		1,000.00
		1,281.35
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$33.00	
For maintenance of improvement	31.29	
		64.29
July 1, 1905, balance unexpended		1,217.06
July 1, 1905, outstanding liabilities		18.75
July 1, 1905, balance available		1,198.31
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905		500.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

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BELOW LOCK NO. 5.

Amount appropriated by river and harbor act approved March 3, 1905	$163,000.00
July 1, 1905, balance unexpended	163,000.00
Amount (estimated) required for completion of existing project	88,000.00

APPROPRIATIONS.

August 14, 1876	$7,300	March 3, 1899	$743
June 18, 1878	18,000	June 13, 1902	1,000
March 3, 1879	18,000	March 3, 1905	1,000
June 14, 1880	15,000	March 3, 1905 (purchase and repair of Little Kanawha Navigation Company's locks)	163,000
March 3, 1881	40,000		
August 2, 1882	31,000		
August 5, 1886	16,875		
August 11, 1888	25,000		
September 19, 1890	40,000	Total	378,418
June 3, 1896	1,500		

NOTE.—Received from sale, $186.10.

F F 3.

OPERATING AND CARE OF LOCK AND DAM ON LITTLE KANAWHA RIVER, WEST VIRGINIA.

Lock and Dam No. 5 is located about 41 miles from the mouth of the river (Parkersburg), and is a continuation of the slack-water system controlled by the Little Kanawha Navigation Company. The locks and dams (four) owned by the navigation company often cause a stoppage of navigation, owing to their leaky condition. During the past fiscal year navigation was suspended 143 days on account of low water, 16 days on account of ice, and 3 days on account of high water. The suspension caused by low water is almost entirely due to the bad condition of the locks and dams owned by the navigation company.

The following work, necessary to keep the lock and dam and their appurtenances in good condition, was accomplished during the year: Minor repairs were made to the valves and gates of the lock; 22 pieces of decking replaced on the dam; 320 linear feet of cement walk laid; and 2 sheds (for fuel) rebuilt. The reconstruction of the storehouse was completed. A well, for supplying the employees with water, was driven near the storehouse. As a protection to the Government land 80 trees were planted. At the close of the year the government structures at this site were in reasonably good condition.

ALLOTMENTS.

November 28, 1891	$1,500.00	July 14, 1900	$2,271.61
July 15, 1892	4,426.65	June 25, 1901	3,470.84
July 21, 1893	3,837.97	July 12, 1902	2,705.25
July 16, 1894	3,491.03	July 20, 1903	4,318.97
July 20, 1895	3,378.17	March 7, 1904	500.00
July 24, 1896	830.72	July 13, 1904	1,931.79
July 23, 1897	1,684.03		
August 3, 1898	3,038.53	Total	39,717.14
July 21, 1899	2,331.58		

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Summary of expenditures for operating and care of lock and dam on Little Kanawha River, West Virginia, for the fiscal year ending June 30, 1905.

Office expenses and superintendence	$507.57
Labor	1,319.87
Fuel	12.80
Expenses	29.74
Repairs	1,922.08
Total	3,792.06

COMMERCIAL STATISTICS.

Commerce that has passed Lock No. 5 since it was opened to navigation.

Year.	Quantity.	Year.	Quantity.
Fiscal year—	*Tons.*	Calendar year—	*Tons.*
1890	140,115	1897	127,943
1891	190,688	1898	122,405
1892	244,254	1899	138,664
1893	137,072	1900	119,439
1894	106,412	1901	122,190
1895	179,240	1902	69,706
1896	105,212	1903	73,464
1897	176,169	1904	66,415

Detailed statement of commerce for calendar year 1904.

Articles.	Quantity.	Articles.	Quantity.
	Tons.		*Tons.*
Bricks	3	Iron	2b
Carbon black	880	Live stock	5
Casing	675	Lumber	400
Coal	71	Salt	57
Coke	40	Saw logs	31,918
Dry goods	137	Sundries	4,108
Farm products	733	Ties, railroad	25,685
Groceries and paints	392		
Hardware	1,341	Total	66,415

Number of passengers, 7,862.

NOTE.—The falling off in the amount of freight handled is due to the unusual continuance of the extreme dry season, followed by freezing weather.

List of stern-wheel boats plying on the Little Kanawha River, West Virginia, during calendar year 1904.

Name of boat.	Length.	Breadth.	Depth.	Tonnage.
Steamboats:	*Feet.*	*Feet.*	*Feet.*	
Darling	100	22.7	3.6	78.80
Burnadina King	90	18.0	3.5	106.00
French	104	19.5	4.2	75.78
Telephone	93	16.0	2.6	73.00
Excel	95	18.0	3.0	60.00
Boats propelled by gasoline:				
Clipper	75	8.0	1.7	10.00
Calhoun	70	8.0	2.0	10.00
Edith H	60	9.0	2.0	12.00
Creston	65	9.0	2.4	12.00
Hurricane	65	7.5	1.8	10.00
Mabel B	80	7.5	1.7	10.00
Carbon Black	85	7.5	2.0	10.00
H. B. Stout	85	7.5	2.0	10.00
Orion	50	7.5	2.0	6.00
Winona	85	7.5	2.0	10.00
Wabash	70	8.0	2.0	10.00
Leone	70	8.0	2.5	12.00
Joe Kellar	50	9.0	3.5	10.00
Eagle	60	8.0	2.5	10.00
Hazel Bell	60	8.0	2.5	10.00
Industry	60	8.0	2.5	10.00
Return	65	7.5	3.0	10.00
Eleanor	70	9.0	3.0	12.00

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Report of lockages at Lock No. 5, Little Kanawha River, West Virginia, for the calendar year ending December 31, 1904.

Steamboats	1,045
Barges and flats	336
Rafts	1,267
Miscellaneous	1
Total	2,649
Number of lockages	2,647

F F 4.

IMPROVEMENT OF KANAWHA RIVER, WEST VIRGINIA.

An approved project for the expenditure of the balance remaining from the funds appropriated by the act of June 4, 1897, provides for the following: Grading land, constructing sewers, walks, additional fences, back porches, lock houses (2) at Lock No. 6, office buildings, coal sheds, water-closets, carpenter and blacksmith shops, storehouse, guide cribs at Locks Nos. 2, 3, and 11, bridge at Lock No. 8, and retaining walls at Lock No. 11; purchasing additional land at Locks Nos. 5 and 6, window blinds, sinks, and pumps for lock houses, lights for use at the movable dams, and machinery for operating gates, etc., with steam; concreting floors in cellars of lock houses; protecting river banks; equipping telephone system with metallic circuit, and dredging.

Under the above-mentioned project the following work was accomplished: About 60 per cent of the grading, 90 per cent (2,250 linear feet) of the sewers, 90 per cent (6,735 linear feet) of the walks, and 85 per cent of the retaining walls at Lock No. 11 were finished; the additional fences required, lock houses (2) and storehouse at Lock No. 6, and concreting floors in cellars of lock houses completed; window blinds, sinks, and pumps for lock houses purchased and placed; and the office buildings, coal sheds, water-closets, and shops lack about 15 per cent of completion.

But little work has been done toward the construction of the guide cribs at Locks Nos. 2, 3, and 11 under contract with Cassady & Hanna. This is partly due to the contractors' inability to secure a suitable dredge last year.

An order was placed with R. E. Dietz Company for the outdoor lights necessary at the movable dams. It is thought that two acetylene-gas searchlights at each dam will be sufficient to illuminate the works for operation at night.

Some work has been done toward the protection of river banks; materials received for the construction of a bridge across the Government right of way at Lock No. 8, and a contract entered into with The Miller Supply Company for furnishing the material, etc., necessary for equipping the United States telephone line with a metallic circuit.

The dredge, crane boat, and towboat belonging to this river were employed in dredging in the pools. During the year 15,640 cubic yards of material was removed. Additional work accomplished by this plant is given under the report for operating and care of locks

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and dams on Kanawha River. Extensive repairs were made to the dredge, and a steam steering gear was installed on the towboat. The installation of an electric-light plant on the towboat is in progress.

The commercial statistics for this river are contained in the report for operating and care of locks and dams on Kanawha River.

Money statement.

July 1, 1904, balance unexpended	$131,000.45
Amount received from sales	275.32
	131,275.77
June 30, 1905, amount expended during fiscal year, for works of improvement	32,036.49
July 1, 1905, balance unexpended	99,239.28
July 1, 1905, outstanding liabilities	1,110.09
July 1, 1905, balance available	98,129.19
July 1, 1905, amount covered by uncompleted contracts	38,092.35

APPROPRIATIONS.

March 3, 1873	$25,000.00	February 1, 1888	$30,370.15
June 23, 1874	25,000.00	August 11, 1888	350,000.00
March 3, 1875	300,000.00	September 19, 1890	300,000.00
August 14, 1876	270,000.00	July 13, 1892	225,000.00
June 18, 1878	222,000.00	March 3, 1893	500,000.00
March 3, 1879	150,000.00	March 2, 1895	580,700.00
June 14, 1880	200,000.00	June 4, 1897	273,000.00
March 3, 1881	200,000.00		
August 2, 1882	200,000.00	Total	4,272,949.45
July 5, 1884	200,000.00	Carried to surplus fund	1,086.31
August 5, 1886	187,500.00		
February 1, 1888	34,379.30	Balance	4,271,863.14

NOTE.—Received from sales, etc., $1,903.02.

F F 5.

OPERATING AND CARE OF LOCKS AND DAMS ON KANAWHA RIVER, WEST VIRGINIA.

The slack-water system of the Kanawha River consists of ten locks and dams, of which two are fixed and eight movable, and provides for 6-foot navigation over a distance of 90 miles from Point Pleasant upstream. As mentioned in previous reports, the cost of maintaining this system is increasing, owing to its length of service. This is especially true at the movable dams, the first of which (Nos. 4 and 5) were completed in 1880 and the last (Nos. 9, 10, and 11) in 1898. At the close of the year the works were practically in good condition.

The precipitation in the Kanawha Valley was exceptionally light during the calendar year 1904. This and the very light precipitation during the previous year created an unusual scarcity of water in the Kanawha and its tributaries. To maintain the pools during the fall

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months necessitated the use of brush, weeds, and straw to stop the leakage through the dams. Navigation was suspended on account of ice about twenty-five days at the movable and forty-five days at the fixed dams. With the exception of the bending of a number of weir wickets and the loss of a number of joint covers, caused by the ice, the movable dams were operated without unusual accident or delay.

During the fiscal year the movable dams were operated as follows: Dams Nos. 4 and 9, raised 6 and lowered 5 times; Dams Nos. 5 and 6, raised 5 and lowered 4 times; Dam No. 7, raised 4 and lowered 4 times; Dams Nos. 8 and 10, raised 5 and lowered 5 times; Dam No. 11, raised 3 and lowered 3 times.

The following is a summary of the work accomplished:

Lock No. 2.—New upper and lower gates were completed and hung. 3 guard cribs rebuilt from the low-water line, and bank protected by placing 300 cubic yards of stone and planting 300 willows.

Lock No. 3.—Material for new lock gates was received and work of construction commenced; new cushion timbers placed on lower miter sill of lock, and 364 cubic yards of stone placed as bank protection.

Lock No. 4.—A new set of pass trestles, 2 weir trestles, and 1 wicket were placed in the dam, and 3 lock houses wired for electric light.

Lock No. 5.—Four new wickets were placed in dam and 8 old ones repaired, and a new shingle roof placed on 1 lock house.

Lock No. 6.—Under contract with George W. Jobe, a storehouse for oils was built. Fourteen new weir wickets were placed in the dam.

Lock No. 7.—A new shingle roof was put on the blacksmith shop.

Lock No. 8.—The lower guard crib and shop were repaired, 8 new check posts set on lock walls, and 28 weir chains replaced. Fourteen shade trees were planted as protection to Government land.

Lock No. 9.—One new weir wicket and prop and 7 new check posts were placed. Fifty shade trees were planted as protection.

Lock No. 10.—A new service boat, built under contract, was received, 5 check posts placed on lock wall, 224 feet of fence rebuilt, and 151 shade trees planted to protect the Government land.

Lock No. 11.—A faulty chimney in one of the lock houses was rebuilt, and a new service boat, built under contract, received.

Where needed, the lock houses, fences, etc., were painted, and the interior of some of the houses papered. Many repairs of a minor character were made by the regular force at the locks.

United States telephone line.—A contract was entered into with A. J. Ferrell for furnishing the new poles required in repairing the line. Owing to the interference by induction from other lines the line is to be equipped with a metallic circuit.

U. S. dredge Addison.—In addition to the work reported under improving Kanawha River, 38,170 cubic yards of deposit, 48½ cubic yards of stone, and 84 snags were removed. The dredge required extensive repairs, the greater part of which were completed at the close of the year.

U. S. towboat *James Rumsey* was employed as tender to the dredge, and also in transporting materials, etc., for repairs. To permit of greater ease in handling, the boat was equipped with a steam steering gear. Under contract with the Triple-State Electric Company an electric-light plant is being installed on the boat.

U. S. launch *Mascot* was employed transporting employees and distributing supplies.

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ALLOTMENTS.

For fiscal year 1885	$7,075.00	August 2, 1897	$22,700.77
For fiscal year 1886	8,710.00	July 26, 1898	36,331.90
July 8, 1886	11,170.00	September 29, 1898	2,650.00
June 17, 1887	13,289.00	June 2, 1899	14,000.00
February 4, 1888	3,549.70	August 2, 1899	36,416.13
August 16, 1888	19,990.02	April 10, 1900	1,400.00
July 11, 1889	19,261.61	July 13, 1900	49,444.47
July 16, 1890	25,702.27	July 3, 1901	47,506.31
October 9, 1890	3,400.00	May 16, 1902	2,500.00
July 14, 1891	19,453.00	June 23, 1902	9,500.00
July 6, 1892	21,891.64	July 17, 1902	52,859.86
July 12, 1893	24,549.41	July 14, 1903	61,946.86
July 10, 1894	30,600.00	July 15, 1904	60,770.71
July 2, 1895	30,200.00		
July 25, 1896	37,082.59	Total	673,951.25

Withdrawn:		
Fiscal year 1888	$2,049.70	
Fiscal year 1890	.01	
		$2,049.71
Balance		671,901.54

Summary of expenditures for operating and care of locks and dams on Kanawha River, West Virginia, for the fiscal year ending June 30, 1905.

Office expenses and superintendence	$7,164.33
Labor	40,858.07
Fuel	546.01
Expenses	618.89
Repairs	12,692.97
Total	61,880.27

ABSTRACT OF CONTRACTS IN FORCE FOR KANAWHA RIVER, WEST VIRGINIA.

Buildings, fences, etc.

Contractor: W. H. Hanna.

Rate: Excavation at 40 cents per cubic yard; brick masonry, in cement mortar, $18 per thousand bricks; brick masonry, in lime mortar, $18 per thousand bricks; board fencing, 20 cents per linear foot; picket fencing, 25 cents per linear foot; wire fencing, 15 cents per linear foot.

Buildings above foundations: At Lock No. 2—Office, $597; coal shed and water-closet, $109; shop, $730. At Lock No. 3—Office, $597; coal shed and water-closet, $275; shop, $730. At Lock No. 4—Coal shed (large), $212; coal shed (small), $97; double water-closets, $77 each; shop, $1,112. At Lock No. 5—Coal shed and water-closet, $275; coal shed, $97; water-closet, $46; shop, $1,112. At Lock No. 6—Storehouse, office, and carpenter shop, $1,800; blacksmith shop, $325. At Lock No. 7—Office, $597; back porch, $85. At Lock No. 8—Office, $597; back porch, $85. At Lock No. 9—Office, $597. At Lock No. 10—Office, $597; back porch, $85. At Lock No. 11—Shop, $557; water-closets, $46 each.

Date of approval: July 9, 1904.

Date of beginning: August 11, 1904.

Date of expiration: 350 days, Sundays and legal holidays excepted.

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Guide cribs at Locks Nos. 2, 3, and 11.

Contractors: R. B. Cassady and W. H. Hanna.
Rate: At Locks Nos. 2 and 3—Excavation at 65 cents per cubic yard; embankment, 50 cents per cubic yard; stone filling, $1.25 per cubic yard; timber, $40 per thousand; driftbolts, 2½ cents per pound. At Lock No. 11—Excavation, 80 cents per cubic yard; embankment, 50 cents per cubic yard; stone filling, $1.25 per cubic yard; timber, $40 per thousand; driftbolts, 2½ cents per pound.
Date of approval: September 7, 1904.
Date of beginning: October 9, 1904.
Date of expiration: 450 days, Sundays and legal holidays excepted.

Electric-light plant for U. S. towboat James Rumsey.

Contractor: Triple-State Electric Company.
Rate: $994.75.
Date of contract: April 7, 1905.
Date of beginning: May 7, 1905.
Date of expiration: June 6, 1905. (Time limit waived.)

Telephone poles.

Contractor: A. J. Ferrell.
Rate: Section No. 2—Poles, 24-foot at $1.15 each; poles, 35-foot, $3.10 each. Section No. 4—Poles, 24-foot, $1.10 each; poles, 35-foot, $3.10 each. Section No. 5—Poles, 24-foot, $1.25 each; poles, 35-foot, $3.20 each. Section No. 6—Poles, 24-foot, $1.30 each; poles, 35-foot, $3.40 each.
Date of contract: May 16, 1905.
Date of beginning: June 15, 1905.
Date of expiration: July 5, 1905. (Time limit waived.)

Telephone supplies.

Contractor: The Miller Supply Company.
Rate: Galvanized-iron wire at $4.15⅛ per 100 pounds; weatherproof galvanized-iron wire, $18 per mile; standard glass insulators, $22.50 per thousand; standard transposition glass insulators, $5.50 per hundred; cross-arm braces, $35 per thousand; cross arms, $6.50 per hundred; lag screws, $1.30 per hundred; carriage bolts, 45 cents per hundred; oak pins, $6 per thousand; anchors, $35 per hundred; round washers, ½-inch, 2.7 cents per pound; round washers, ⅝-inch, 4 cents per pound; wire staples, 2.5 cents per pound.
Date of contract: June 8, 1905.
Date of beginning: July 8, 1905.
Date of expiration: July 28, 1905.

COMMERCIAL STATISTICS.

Statement of number of tons of coal, including that manufactured into coke, shipped by river from mines on the Kanawha below Kanawha Falls for the several years named.

Year.	Quantity.	Year.	Quantity.
Fiscal year—	*Tons.*	Calendar year—	*Tons.*
1890	966,462	1897	650,680
1891	1,030,454	1898	1,089,160
1892	1,071,511	1899	942,800
1893	919,320	1900	1,240,680
1894	1,032,840	1901	1,370,180
1895	879,304	1902	987,880
1896	922,000	1903	1,333,920
1897	848,600	1904	1,094,700

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Tonnage of the Kanawha River for the calendar year ending December 31, 1904.

Articles.	Quantity.	Tonnage.
Coal ..... bushels..	27,367,500	1,094,700
Timber ..... feet B. M..	25,177,000	44,060
Staves, oak ..... number..	98,000	735
Bark and wood for tanning ..... cords..	642	1,252
Hoop poles ..... number..	678,000	1,695
Laths ..... do....	1,402,000	280
Railroad ties, oak ..... do....	324,430	34,606
Shingles ..... do....	308,000	46
Bricks ..... do....	386,800	967
Salt ..... barrels..	4,472	626
Merchandise and produce in steamboats ..... tons..	.....	54,186
Total	.....	1,233,153

Total tonnage of the Kanawha River for the several years named.

Year.	Quantity.	Year.	Quantity.
Year ending June 30—	*Tons.*	Calendar year—	*Tons.*
1890	1,127,232	1897	832,002
1891	1,225,355	1898	1,244,334
1892	1,360,750	1899	1,124,364
1893	1,116,537	1900	1,475,930
1894	1,222,530	1901	1,547,610
1895	1,082,342	1902	1,090,797
1896	1,162,782	1903	1,506,043
1897	1,124,843	1904	1,233,153

NOTE.—During the calendar year 1904 the continued dry season, followed by freezing weather, interfered considerably with navigation. The rainfall was exceptionally light in the Kanawha Valley.

Commerce passing each of the 10 locks and dams in Kanawha River, West Virginia, during the calendar year ending December 31, 1904.

Articles.	Lock No. 2.	Lock No. 3.	Lock No. 4.	Lock No. 5.	Lock No. 6.
Coal ..... bushels..	1,136,000	2,215,300	8,388,500	15,524,000	17,692,000
Lumber, etc ..... feet..	179,875	502,350	535,500	1,000,260	2,039,900
Shingles ..... number..	37,500	136,000	102,500	69,500	79,000
Laths ..... do....	10,000	30,700	77,000	1,000	47,750
Bricks ..... do....	.....	70,000	70,850	182,350	120,475
Miscellaneous freight ..... tons..	5,166	7,350	12,249	20,489	17,116
Salt ..... barrels..	62	155	165	519	2,778
Railroad ties ..... number..	.....	.....	.....	.....	52,265
Staves ..... do....	.....	.....	.....	.....	11,100
Hoop poles ..... do....	.....	.....	800	.....	264,400
Steamboats ..... do....	1,201	1,319	1,752	1,735	1,686
Coal barges ..... do....	169	334	1,165	1,839	2,521
Other craft ..... do....	97	141	144	150	87
Lockages ..... do....	1,300	1,464	1,228	1,513	1,090
Dams up ..... days..	.....	.....	222	235	217
Passengers ..... number..	7,002	9,192	13,019	19,623	20,862

Articles.	Lock No. 7.	Lock No. 8.	Lock No. 9.	Lock No. 10.	Lock No. 11.
Coal ..... bushels..	17,810,500	23,999,900	26,077,100	26,279,400	26,751,000
Lumber, etc ..... feet..	2,807,873	9,990,092	8,186,700	10,408,300	9,825,870
Shingles ..... number..	92,000	172,300	58,000	37,000	19,000
Laths ..... do....	880,500	935,300	521,500	1,104,000	1,354,000
Bricks ..... do....	132,200	117,100	67,700	170,100	204,400
Miscellaneous freight ..... tons..	19,628	18,979	16,135	18,811	19,784
Salt ..... barrels..	3,288	3,203	1,586	2,290	1,864
Railroad ties ..... number..	96,813	182,064	197,995	210,100	324,430
Staves ..... do....	18,000	18,000	9,900	74,500	98,000
Hoop poles ..... do....	345,400	634,600	237,600	550,200	678,000
Bark ..... cords..	.....	.....	.....	.....	1
Steamboats ..... number..	1,616	1,858	1,752	1,874	2,112
Coal barges ..... do....	2,579	3,362	3,978	3,914	4,049
Other craft ..... do....	209	204	156	185	262
Lockages ..... do....	1,238	1,380	1,309	1,306	1,087
Dams up ..... days..	231	223	223	202	168
Passengers ..... number..	17,122	15,309	11,083	13,699	18,431

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List of steamboats plying Kanawha River, West Virginia, for the calendar year 1904.

[All stern-wheel, except as noted.]

Name of boat.	Character.	Length.	Breadth.	Depth.	Tonnage.
		Feet.	*Feet.*	*Feet.*	
Greenland [a]	Packet	204.4	31.9	5.4	294.00
Kanawha	do	185.0	35.0	4.0	429.07
Henry M. Stanley	do	180.0	32.4	5.5	293.71
Greenwood	do	165.0	32.0	4.5	270.00
Ben Hur	do	165.0	30.5	4.8	284.00
Columbia	do	156.0	24.2	4.0	197.96
Big Kanawha	do	152.0	30.0	4.5	212.00
Chas. B. Pierce	do	145.0	33.3	5.4	223.00
Argand	do	130.0	24.8	4.0	96.00
Liberty [a]	do	128.4	20.5	4.2	68.00
Baxter	do	121.0	22.0	3.5	75.00
Evergreen	do	120.0	22.0	4.0	99.00
Calvert	do	120.0	20.0	3.5	110.00
Neva	do	117.0	21.6	3.4	71.48
Enos Taylor	do	116.0	20.0	3.5	64.00
Unique [b]	do	90.0	14.0	4.6	33.00
Daisy	do	75.0	14.0	2.0	17.00
Genevieve	do	59.0	11.9	2.6	14.44
Laura	do	54.0	8.0	2.5	9.00
Cuba	do	50.0	9.6	2.5	10.00
Pauline [b]	do	45.7	11.3	4.6	11.00
J. P. Lightner	do	40.0	12.6	3.0	8.00
E. R. Andrews	Towboat	165.0	32.5	5.2	351.07
Florence Marmet	do	155.0	30.0	5.0	263.00
Robert P. Gillham	do	149.5	31.5	4.3	158.00
Otto Marmet	do	149.5	24.0	4.8	135.20
Convoy	do	146.0	26.5	3.7	170.53
Henry DeBus	do	143.0	26.0	5.0	193.00
Catherine Davis	do	135.0	26.0	4.0	334.00
Lucie Marmet	do	134 5	25.8	4.8	191.36
Val. P. Collins	do	132.6	24.6	4.8	119.00
J. B. Lewis	do	132.0	22.0	4.5	162.00
D. T. Lane	do	129.6	24.1	4.0	146.94
Douglas Hall	do	127.5	27.2	4.3	122.00
Mountain State	do	122.0	29.6	5.0	142.00
Little Bill	do	122.0	23.0	4.0	110.00
George Gardner	do	120.0	22.0	3.6	85.00
Winifrede	do	119.4	24.9	4.6	97.00
Eleanor	do	117.0	28.0	3.8	106.00
Annie L	do	115.8	20.3	3.1	114.69
Geo. Matheson	do	112.0	22.0	4.0	124.06
W. B. Calderwood	do	112.0	24.5	4.6	85.55
Reba Reeves	do	107.0	22.0	3.4	63.11
Scout	do	101.1	20.6	3.5	77.00
Antoinette	do	100.7	19.9	3.9	54.00
Mary Stewart	do	100.0	20.0	3.2	91.00
Ollie Neville	do	92.9	26.5	3.4	70.00
Nellie England	do	92.0	18.0	3.5	85.00
Vivian	do	90.0	21.0	3.5	75.00
Gazette	do	69.0	15.8	1.8	10.00
Henry H	do	51.0	13.0	2.0	13.00
James Rumsey [b]	U. S. towboat	120.0	22.0	4.3	125.00
Golden Rod	U. S. light-house tender	150.0	26.5	3.7	143.58
Mascot [b]	U. S. launch	61.0	8.1	3.4	7.00
Billy Martin [b]	Pump and harbor	89.0	14.3	4.0	28.15
Iron Duke [b]	do	88.0	13.5	3.7	30.63
Nancy E. [b]	Launch	35.0	6.0	4.0	3.00
Lucy [b]	do	28.7	6.0	3.0	2.00
Ruth [b]	do	25.0	5.0	4.0	2.00
Amelia [b]	do	25.0	5.0	4.0	2.00
Soncy [b]	do	18.0	5.0	3.0	1.00
Lizzie D. [b]	do				
Alfred [b]	do				
Thelma [b]	do				
Madeline [b]	do				
Ivan [b]	do				
Bertie [b]	do				
Carlhengen [b]	do				
Loon	do				
Prentiss Farley [b]	do				
Anantha [b]	do				

[a] Side-wheel [b] Screw propeller.

Where no dimensions are given the boats are not registered, being small naphtha or gasoline launches.

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APPENDIX G G.

IMPROVEMENT OF MUSKINGUM RIVER, OHIO; OF BIG SANDY RIVER AND ITS FORKS, WEST VIRGINIA AND KENTUCKY, AND OF KENTUCKY RIVER, KENTUCKY.

REPORT OF LIEUT. COL. E. H. RUFFNER, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1905, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Muskingum River, Ohio.
2. Operating and care of locks and dams on Muskingum River, Ohio.
3. Big Sandy River and Levisa and Tug forks, West Virginia and Kentucky.
4. Operating and care of locks and dams on Big Sandy River, West Virginia and Kentucky.
5. Kentucky River, Kentucky.
6. Operating and care of locks and dams on Kentucky River, Kentucky.

ENGINEER OFFICE, UNITED STATES ARMY,
Cincinnati, Ohio, July 10, 1905.

GENERAL: I have the honor to transmit herewith the annual reports of the works under my charge for the fiscal year ending June 30, 1905.

The reports for the Muskingum River have been prepared by Assistant Engineer Edmund Moeser.

The report for the Big Sandy River has been prepared by First Lieut. P. S. Bond, Corps of Engineers.

The report for improving Kentucky River, Kentucky, has been prepared by Assistant Engineer A. M. Campbell.

The report for operating and care of Kentucky River has been prepared by Junior Engineer W. H. McAlpine.

Very respectfully, your obedient servant,

E. H. RUFFNER,
Lieut. Col., Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

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G G 1.

IMPROVEMENT OF MUSKINGUM RIVER, OHIO.

At the beginning of the fiscal year the unfinished work included in the project as then approved for the application of the balance available from appropriations for this work, was the completion of a lock master's dwelling at Lock No. 4. The present project comprises raising the crest of Dam 3, building a combined lock master's house and storehouse at Lock 10, and rebuilding Lock and Dam No. 11.

Under contract approved June 30, 1904, Rechsteiner Brothers completed the lock master's dwelling at Lock 4. The foundation walls and the exterior first-story walls are of concrete and were built by hired labor. The remainder of the work required to complete the dwelling was done under formal contract. The total cost of the building was $2,209.62.

Steps were taken for the purchase of material required for raising the crest of Dam 3, and plans are in preparation for the construction of a lock house at No. 10. A survey was commenced with the view to determining the exact location and providing the necessary lands for Lock and Dam No. 11.

Commercial statistics are reported under the head of "Operating and care," etc.

Money statement.

July 1, 1904, balance unexpended	$3,225.67
Amount appropriated by river and harbor act approved March 3, 1905	118,000.00
Received from sale of property at public auction	47.30
	121,272.97
June 30, 1905, amount expended during fiscal year, for works of improvement	2,073.05
July 1, 1905, balance unexpended	119,199.92
July 1, 1905, outstanding liabilities	32.88
July 1, 1905, balance available	119,167.04
July 1, 1905, amount covered by uncompleted contracts	1,357.00

APPROPRIATIONS.

August 11, 1888	$102,000.00
July 1, 1898	6,000.00
July 13, 1902	10,300.00
March 3, 1905	118,000.00
	236,300.00
Received from sale of property	239.37
Total	236,539.37

ABSTRACT OF CONTRACTS IN FORCE ON MUSKINGUM RIVER DURING THE FISCAL YEAR ENDING JUNE 30, 1905.

Contract for building one lock master's dwelling at Lock No. 4, Muskingum River, Ohio.

Name of contractor: Rechsteiner Brothers.
Date of approval: June 30, 1904.
Date of beginning: On or before July 22, 1904.
Date of expiration: Ninety fair working days from date of beginning.

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Item.	Contract price.
Building 1 lock master's dwelling, except the concrete foundation and first-story walls, at Lock No. 4, Muskingum River, Ohio	$1,347.87

Completed.

Contract for furnishing and delivering timber for raising crest of Dam No. 3, Muskingum River, Ohio.

Name of contractor: W. S. Gregg & Co.
Date of approval: June 15, 1905.
Date of beginning and date of expiration: Delivery of timber to be completed within three months after date of receipt by contractor of notice of approval of contract.

Item.	Contract price.
76,267 feet B. M. white oak timber for the lot	$1,357.00

G G 2.

OPERATING AND CARE OF LOCKS AND DAMS ON MUSKINGUM RIVER, OHIO.

During the past year this system, comprising 10 locks and dams, has been operated and kept in repair and four of the lateral canals, aggregating 2½ miles in length, have been maintained in navigable condition. The canal at Taylorsville, 1 mile long, which is not now required for navigation, has been kept open to furnish certain water power with which the United States is charged.

During the past winter navigation was suspended on account of ice for a period of seventy-nine days.

The following is a summary of the work, in addition to ordinary maneuvering of the locks and care of property, which was done at the different parts of the system during the year:

At Lock No. 1, Marietta.—Replaced broken parts of the apparatus used for operating valves in middle gates of lock. Prepared timbers for use in replacing decayed parts of lock gates. Labor was required at intervals during the past winter to keep the lock in working order by clearing ice, drift, and sedimentary deposits from the lock.

At Lock and Dam No. 2, Devols.—Rebuilt a section, 70 feet in length, of the guide crib above the river wall of lock.

At Lock and Dam No. 3, Lowell.—Shaped up the grounds around the lock house after filling in 257 cubic yards earth and laid 400 feet gravel walk from lock house to the county road; built an outhouse and cistern at the lock house and laid a sewer pipe from house to river. Unwatered the lock above upper gates by means of the needle dam; repaired the valve stem fastening and cleared mud and trash from the valve recess. Made new operating chains for the gate valves. Replaced loose drift bolts in the sheathing of dam.

At Lock and Dam No. 4, Beverly.—Refilled 440 yards earth over about 250 feet of the eroded canal embankment. Repairs were made to the embankment back of the right abutment of dam by refilling

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sink holes with 50 yards material, replacing 200 square feet of the downstream slope wall and raking out and refilling with cement mortar open joints in the upstream slope wall. Prepared timbers for repair of the upper gates of lock. Refilled empty cribs and resheathed the lower apron of the dam for 26 feet of its length.

At Lock and Dam No. 5, Luke Chute.—Under contract with Clifton Brothers, approved October 3, 1904, 31 feet in length of the guide crib above the river wall of lock was reconstructed with concrete. Damaged masonry of the lock wall was replaced with 2 cubic yards concrete. A concrete floor was laid in cellar of lock house and minor repairs were made to this building. Resheathed 26 feet of the lower apron of the dam.

At Lock and Dam No. 6, Stockport.—Removed 3 cubic yards loose rock from the lower approach to lock and placed 105 cubic yards stone covering on the bank back of the right abutment of dam.

At Lock No. 7, McConnelsville.—Replaced the decayed wooden bulkhead of wharf in canal with a concrete retaining wall 100 feet in length. Refilled and graded over 1,400 feet of the canal bank.

In the workshop at this place all timber used in repair of lock gates and maintenance of floating plant was planed and prepared. The work of constructing two dump scows was completed, and at the close of the year the alteration of the floating pile driver was in progress for use as an auxiliary dredging plant in the removal of shoals.

At Lock and Dam No. 8, Eagleport.—Extended the wooden guide crib below the land wall of lock a distance of 115 feet, with a view to prevent shoaling in the lower approach to lock. The crib was built to a height of 15 feet above the normal level of the pool. Made new bonnet pins for the upper gates of lock.

At Lock and Dam No. 9, Taylorsville.—Under contract with Clifton Brothers, approved October 3, 1904, a section of the old wooden slope dam 119 feet in length was replaced with a Portland cement concrete slope and 31 feet in length of the guide crib in the upper approach to the lock was rebuilt with concrete. The following is the aggregate amount of material expended:

Excavation in the old work	cubic yards	480
Timber in crib under lower apron	feet B. M.	9,819
Concrete	cubic yards	1,144

About 600 cubic yards of stone was furnished by the United States, filling cavities in the rock bottom under the reconstructed section of dam.

Rebuilt both leaves of the guard gates at head of canal and reconstructed the lower gates of the lock above 8-foot stage of river.

Built a concrete revetment 240 feet in length on the canal embankment from guard gates to pivot pier of drawbridge. Refilled washouts in the canal embankment at old Lock 9 with 3,980 cubic yards earth over a distance of 656 feet. Repaired the inside leaf of the lower gates of old lock. Built a storehouse and outhouse at the lock.

At Lock and Dam No. 10, Zanesville.—Placed 289 cubic yards of stone covering over 900 feet of the eroded canal embankment. Reconstructed both leaves of the guard gates at head of canal and replaced decayed timbers in the lower, middle, and upper gates of the lock. Placed splash boards on the dam during the dry season of 1904. Removed loose stone from around the miter sill of guard

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gates and employed labor when necessary to assist in clearing drift, ice, and mud deposits from the lock and canal and to mow the canal banks. Made new operating chains for valves in lower gates of lock.

The U. S. dredge *Malta* was usefully employed throughout the working season in dredging out the canals, approaches to locks, and channels in pools, and in removing snags and other obstructions. A table is appended showing the localities worked over and cost of dredging. The dredge was attended by the U. S. S. *Vega*. Included in the work accomplished by the dredge there was dredged, for the betterment of the water service of the city of Zanesville, 3,860 cubic yards mud, stone, and slag, the cost to the city for the use of the plant being $210.

The floating plant, consisting of dredge, steamboat, scows, pile driver, barges, etc., was kept in serviceable condition; many of the worn-out parts of the dredge *Malta* were renewed. Two dump scows and a quarter boat for the crew of the dredge were built.

The U. S. S. *Vega* was employed during the working season in towing material used in reconstruction work and as dredge tender.

Establishment of harbor lines at Zanesville.—Four lines, aggregating 6 miles in length, as tentatively determined at a public hearing held April 18, 1905, relative to the establishment of harbor lines along the Muskingum River at Zanesville, were marked on the ground, and maps are being prepared showing the lines, with proper description, with a view to their final approval by the Secretary of War. The cost of this work up to the close of the fiscal year was $228.59.

The following is a statement of the amounts and dates of all allotments for this work:

Appropriated August 5, 1886 ..... $20,000.00

Allotted—		Allotted—	
July 21, 1887	$190,000.00	July 12, 1895	$29,971.20
August 13, 1888	177,623.00	July 24, 1896	41,337.10
July 1, 1889	232,080.00	July 23, 1897	43,527.50
July 19, 1890	195,665.00	July 23, 1898	35,950.58
May 28, 1891	20,000.00	July 25, 1899	44,954.30
July 8, 1891	155,200.00	October 16, 1899	1,500.00
November 9, 1891	39,980.00	July 14, 1900	44,921.96
November 24, 1891	1,200.00	June 25, 1901	38,251.42
December 9, 1891	1,200.00	July 25, 1902	47,576.72
January 5, 1892	12,241.54	July 10, 1903	50,358.37
August 3, 1892	42,919.47	July 11, 1904	54,000.75
July 22, 1893	52,745.36		
July 25, 1894	47,157.66	Total	1,620,361.93

Special work authorized by act of Congress.

Allotted—

March 21, 1895, protection wall at Zanesville	$1,651.00
June 17, 1895, pier of railroad bridge at Marietta	10,449.60
June 17, 1895, pier of county bridge at Taylorsville	5,834.20
Total	17,934.80

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ABSTRACTS OF CONTRACTS IN FORCE, OPERATING AND CARE OF MUSKINGUM RIVER, DURING THE FISCAL YEAR ENDING JUNE 30, 1905.

Contract for building quarter boat, except hull, for use on Muskingum River, Ohio.

Name of contractor: C. O. Waxler.
Date of approval: July 13, 1904.
Date of beginning and date of expiration: Work to begin within ten days after receipt by the contractor of the hull, and to be completed within a further forty fair working days, Sundays and legal holidays excepted.

Item.	Contract price.
1 quarter boat, except the hull	$943.00

Completed.

Contract for furnishing and delivering lock-gate timber for repairs on Muskingum River, Ohio.

Name of contractors: Roe & Woodrow.
Date of approval: September 12, 1904.
Date of beginning and date of expiration: Delivery to be completed within two months after receipt by contractor of notice of approval of contract.

Item.	Contract price (unit rate per M feet).
34,784 feet B. M. lock-gate timber	$27.50

Completed.

Contract for furnishing and delivering white-oak timber for repairs to cribs and dams on Muskingum River, Ohio.

Name of contractor: J. L. Sutter.
Date of approval: September 12, 1904.
Date of beginning and date of expiration: Delivery to be completed within two months after receipt by contractor of notice of approval of contract.

Item.	Contract price (unit rate per M feet).
56,844 feet B. M. white-oak timber	$16.90

Completed.

Contract for furnishing material and labor for repair of Dam No. 9, and guide cribs at Locks 5 and 9, Muskingum River, with concrete.

Name of contractors: Clifton Brothers.
Date of approval: October 3, 1904.
Date of beginning and date of expiration: Work to be commenced within ten calendar days after the date of receipt by the contractor of notice of approval of contract, and to be completed within a further sixty-five fair working days, Sundays and legal holidays excepted.

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Item.		Contract price (unit rate).
Repairs to Dam No. 9:		
Excavation	cubic yard	$0.75
Timber	M feet B. M.	30.00
Concrete	cubic yard	4.87
Reconstruction of guide cribs at Locks 5 and 9:		
Excavation	do	.75
Concrete	do	4.87

Completed.

Summary of expenditures for operating and care of locks and dams on Muskingum River, Ohio, for the fiscal year ending June 30, 1905.

Office expenses, superintendence, and contingencies	$4,943.35
Labor	24,411.17
Fuel	1,075.61
Expenses	1,239.82
Repairs	23,378.62
Total	55,048.57

In this summary is included the sum of $9,900, which amount was transferred to the appropriation for "Improving Ohio River: General improvement." The work for which the amount was allotted (removing bar at mouth of Muskingum River) was performed by the Ohio River dredges.

Detailed statement and cost of dredging on Muskingum River under the appropriation for "Operating and Care of Canals and Other Works of Navigation, indefinite," for the fiscal year ending June 30, 1905.

Date.	Locality.	Material excavated.	Total cost.
July	Lowell	19,085 yards mud, at 2.8178 cents	$537.77
August	do	2,740 yards mud, at 3½ cents	95.90
	Beverly	5,950 yards mud and gravel, at 3 cents	178.50
	Baldwin's ripple	8,200 yards mud and gravel, at 3 cents	246.00
	Danas Island	10 snags, at $3	30.00
	Meigs Creek	1 snag	6.00
	Pool No. 6	2 trees and 3 logs, per lot	12.55
	Pool No. 8	6 snags, at $3	18.00
	Eagleport	550 yards sand and gravel, at 8 cents	44.00
September	do	7,486 yards sand, at 8 cents	598.88
	do	12 logs, per lot	14.81
October	do	1,500 yards mud, at 9 cents	135.00
	Taylorsville	8,200 yards sand and gravel, at 3 cents	246.00
	do	2 snags, per lot	7.08
	do	1 log	1.00
	McConnellsville	6,240 yards mud, at 3½ cents	218.40
	do	1 tree	1.00
	do	8 logs, at 50 cents	4.00
November	do	6,990 yards mud, at 5 cents	349.50
	Stockport	300 yards gravel, at 12 cents	36.00
	Gaysport Bridge	181 yards rubblestone, at 40 cents	72.40
	no	49 piling, per lot	54.16
	Zanesville	1,270 yards mud, at 10 cents	127.00
December	do	3,920 yards mud and sand, at 10 cents	392.00
December to April	do	Repairs	1,701.83
April	do	1,500 yards mud, at 10 cents	150.00
May	do	14,460 yards mud, at 6½ cents	939.90
	do	Sunken barge	51.46
June	do	3,880 yards slag, stone, and mud, at 5.44 cents	210.00
	Lowell	5,052 yards mud, at 8.628 cents	435.92
	Devols	624½ yards sand and mud, at 10 cents	62.46
Total			6,977.47

The sum of $4,400.61 for operating U. S. S. *Vega* during the year is not included in the total cost of dredging, but the greater part of that amount was incurred while engaged as tender for the U. S. dredge *Malta*.

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Muskingum River leases.

Location.	Lessee.	Dated.	Expires.
Year ending April 30, 1905.			
Dam No. 1, Marietta	The Phoenix Mill Co	May 1, 1904	May 1, 1924
Dam No. 2, Devols	Gates & Payne	May 1, 1889	May 1, 1909
Dam No. 3, Lowell	John A. McClain	May 1, 1890	May 1, 1910
Do	Reichsteiner Bros	....do	Do.
Do	....do	Nov. 1, 1892	Nov. 1, 1912
Do	E. W. Sprague estate	Dec. 2, 1879	Dec. 15, 1909
Do	First National Bank	June 1, 1900	Do.
Do	E. W. Webster	....do	June 1, 1906
Dam No. 4, Beverly	Robbins Bros	May 1, 1889	May 1, 1909
Do	Langenberg & Abrams	May 1, 1890	May 1, 1910
Do	T. F. Lowe	....do	Do.
Do	Village of Beverly	May 1, 1901	May 1, 1921
Dam No. 6, Stockport	W. H. Phillips	May 1, 1889	July 15, 1904
Dam No. 7, McConnelsville	E. M. Stanbery	Sept. —, 1889	
Do	McConnelsville-Malta Electric Co.	Nov. 1, 1890	Nov. 1, 1920
Dam No. 7, Malta	Ohio and Little Kanawha R. R. Co.	May 1, 1890	May 1, 1925
Dam No. 9, Duncans Falls	John Miller	Dec. 31, 1886	
Dam No. 9, Taylorsville	Frazier & Son	....do	
Do	W. H. Frazier	Jan. 12, 1904	May 1, 1924
Do	Chas. U. Shryock	May 1, 1904	May 1, 1909
Dam No. 10, Zanesville	John T. Drone	May 1, 1890	May 1, 1910
Do	The Zanesville Rwy., Light, and Power Co.	....do	Do.
Do	....do	May 1, 1899	May 1, 1909
Do	....do	Apr. 30, 1903	Apr. 30, 1923
Do	Muskingum Coffin Co	May 1, 1890	May 1, 1910
Do	Zanesville Mantel and Furniture Co.	....do	Do.
Do	T. L. Moorehead	May 1, 1893	May 1, 1913
Do	Muskingum and Ohio River Transportation Co.	Mar. 23, 1903	Nov. 18, 1907
Symmes Creek	Jasper K. McCann	May 1, 1900	May 1, 1906
Year ending May 31, 1905.			
Dam No. 10, Zanesville	John Blankenbuhler	June 1, 1892	June 1, 1909
Do	Frederick Abel estate	....do	Do.

Leases—Water power, land, and rental.

Lessee.	Subject.	Cubic feet of water per minute.	Annual rental.	Rebate.	Rents collected.
The Phoenix Mill Co	Water power	12,000	$300.00		$300.00
Gates & Payne	....do	9,000	108.00		108.00
John A. McClain	....do	7,280	174.72		174.72
Reichsteiner Bros	....do	4,446	106.70		106.70
Do	Land		10.00		10.00
E. W. Sprague estate[a]	....do		5.00		5.00
First National Bank	....do		10.00		10.00
E. W. Webster	....do		5.00		5.00
Robbins Bros.[b]	Water power	1,904	100.00		
Langenberg & Abrams	....do	5,600	114.24		114.24
T. F. Lowe	....do	6,083	109.80		109.80
Village of Beverly	....do	5,000	100.00		100.00
W. H. Phillips[c]	....do	6,390	280.04		277.96
E. M. Stanbery[d]	....do	(e)			
McConnelsville-Malta Electric Co	....do	8,702	208.84		208.84
Ohio and Little Kanawha R. R. Co	Land		2.50		2.50
John Miller[d]	Water rent	(f)			
Frazier & Son[d]	....do	(f)			
W. H. Frazier[g]	....do	6,000	225.00		225.00
Chas. U. Shryock	Land		25.00		25.00
John T. Drone	Water power	7,560	453.60		453.60

[a] Lease transferred to F. H. Wolfram, May 27, 1905.
[b] No collection.
[c] Lease surrendered July 15, 1905, by payment of $277.96, being the amount due at that date.
[d] Perpetual free lease of water power.
[e] Enough to propel 10 run of 4-foot 5-inch millstones.
[f] Enough to propel 15 run of 4½-foot millstones.
[g] Lease transferred to Chas. U. Shryock May 3, 1904.

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Leases—Water power, land, and rental—Continued.

Lessee.	Subject.	Cubic feet of water per minute.	Annual rental.	Rebate.	Rents collected.
The Zanesville Rwy., Light and Power Co.	Water power	6,029	$361.74	.....	$361.74
Do	do	7,399	443.82	.....	443.82
Do	do	50,309	1,760.82	$807.04	953.78
Muskingum Coffin Co	do	4,619	207.86	.....	207.86
Zanesville Mantel and Furniture Co	do	4,794	186.96	.....	186.96
T. L. Moorehead	Land	.....	25.00	.....	25.00
Muskingum and Ohio River Transportation Co.	do	.....	25.00	.....	25.00
Jasper K. McCann	do	.....	5.00	.....	5.00
John Blankenbuhler	Water power	2,700	100.00	.....	100.00
Frederick Abel estate	do	5,200	184.50	.....	184.50
Total		.....	.....	.....	4,730.02

COMMERCIAL STATISTICS.

Commerce of Muskingum River during the calendar year ending December 31, 1904.

LOCK NO. 1.

Month.	Steamboats.	Barges.	Miscellaneous.	Rafts.	Total.	Number of lockages.
March	29	.....	2	4	35	35
April	60	3	2	40	105	78
May	44	3	6	1	54	51
June	54	11	6	.....	71	64
July	65	10	17	.....	92	88
August	74	32	15	.....	121	92
September	83	64	12	1	160	102
October	52	29	13	.....	94	63
November	48	8	7	.....	63	57
December	6	15	4	.....	25	15
Total	515	175	84	46	820	640

LOCK NO. 2.

January	5	.....	.....	.....	5	5
March	40	2	.....	3	45	43
April	59	2	3	.....	64	64
May	62	4	4	.....	70	70
June	71	3	8	.....	82	82
July	65	3	8	.....	76	76
August	64	2	5	.....	71	71
September	58	4	7	.....	69	69
October	59	2	13	.....	74	74
November	51	3	5	.....	59	59
December	24	4	.....	.....	28	28
Total	558	29	53	3	643	641

LOCK NO. 3.

March	42	.....	.....	1	43	43
April	60	4	6	.....	70	70
May	59	2	5	.....	66	66
June	74	4	5	.....	83	82
July	64	3	4	.....	71	68
August	61	1	7	.....	69	69
September	54	4	7	.....	65	65
October	59	3	3	.....	65	65
November	51	2	8	.....	61	60
December	20	2	.....	.....	22	22
Total	544	25	45	1	615	610

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Commerce of Muskingum River during the calendar year ending December 31, 1904—Continued.

LOCK NO. 4.

Month.	Steamboats.	Barges.	Miscellaneous.	Rafts.	Total.	Number of lockages.
March	42	1			43	43
April	58	7	9		74	71
May	62	5	4		71	69
June	69	11	9	2	91	86
July	62	7	11		80	79
August	54	4	17	1	76	71
September	63	20	11		94	87
October	58	2	9		69	68
November	52	7	8		67	61
December	20	4	2		26	25
Total	540	68	80	3	691	660

LOCK NO. 5.

March	10				10	10
April	10	2	3		15	11
May	14	3	2		19	17
June	14	7	5		26	18
July	11	2	7		20	17
August	9	5	9		23	16
September	8	3	18		29	15
October	9	5	6		20	18
November	4	7	1		12	9
Total	89	34	51		174	131

LOCK NO. 6.

March	8	2			10	10
April	10	2	7		19	17
May	11	2	7		20	14
June	16	6	2		24	16
July	11	1	7		19	17
August	10		9		19	17
September	3	2	6		11	9
October	7	4	2		13	10
November	4	5	5		14	8
Total	80	24	45		149	118

LOCK NO. 7.

March	10	1			11	11
April	9	1			10	10
May	13	1			14	13
June	13	5	4		22	17
July	13	3	8		24	22
August	20	12	7		39	30
September	6	4	3		13	9
October	16	11	3		30	19
November	8	14	3		25	16
December	2	2			4	2
Total	110	54	28		192	149

LOCK NO. 8.

March	50	2			52	52
April	54	2	1		57	56
May	65	2	11		78	76
June	67	4	2		73	69
July	67	3	9		79	75
August	77	8	20		105	95
September	68	12	12		92	78
October	66	14	9	1	90	75
November	59	7	8		74	63
December	21	3	24		48	21
Total	594	57	96	1	748	660

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Commerce of Muskingum River during the calendar year ending December 31, 1904—Continued.

LOCK NO. 9.

Month.	Steamboats.	Barges.	Miscellaneous.	Rafts.	Total.	Number of lockages.
March	52	2	1		55	54
April	55	2			57	55
May	63	3	14		80	74
June	67	5	4		76	73
July	69	3	9		81	76
August	87	9	12		108	97
September	75	15	2		92	83
October	73	71	3		147	129
November	58	11	8		77	62
December	21	3			24	22
Total	620	124	53		797	725

LOCK NO. 10.

March	51	6	1		58	57
April	62	1	1		64	56
May	75	4			79	73
June	70	2	3		75	74
July	67	2	6		75	74
August	71	6	21		98	89
September	67	22	7		96	88
October	59	4			63	61
November	53	37	3		93	88
December	18	95			113	67
Total	583	179	42		804	722

SUMMARY.

Lock No.—	Steamboats.	Barges.	Miscellaneous.	Rafts.	Total.	Number of lockages.
1	515	175	84	46	820	640
2	558	29	53	8	643	641
3	544	25	45	1	615	610
4	540	68	80	3	691	660
5	89	34	51		174	131
6	80	24	45		149	118
7	110	54	28		192	149
8	594	57	96	1	748	660
9	620	124	53		797	725
10	583	179	42		804	722
Total	4,233	769	577	54	5,633	5,056

Statement of commerce passing the locks on the Muskingum River, Ohio, during the calendar year ending December 31, 1904.

Articles.	Lock No.—									
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Beer	8	8	8	7	8	8	9	7	7	7
Brick	3	634	629	411	12			685	685	685
Cattle	424	478	461	422	263	225	180	117	40	30
Coal	1,480	1,147	1,326	696	330	311	306	410	477	247
Cement			5	23	23	23	31	36	65	75
Corn	136	125	119	92	35	23	20	141	138	114
Eggs	495	529	523	481	332	290	190	51	42	47
Flour	171	736	713	423	34	31	46	76	128	177
Hay	1,013	1,564	1,385	1,293	325	216	155	472	634	588
Hides	41	41	41	46	41	40	45	45	45	40
Hogs	415	552	555	447	246	220	142	40	17	19
Horses	178	215	217	200	124	124	120	122	117	116
Iron, manufactured	789	935	849	701	650	586	530	412	339	354
Leather	1	1	1	1						
Lime		7	3	3	3	42	4	31	36	31
Lumber	1,798	519	518	361	242	256	262	677	844	831

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Statement of commerce passing the locks on the Muskingum River, Ohio, during the calendar year ending December 31, 1904—Continued.

Articles.	Lock No. —									
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Merchandise, miscellaneous	12,903	16,355	15,703	13,799	5,727	5,371	4,629	15,957	17,087	18,418
Oil	61	123	114	100	72	60	49	25	24	24
Poultry	109	181	128	98	42	30	36	29	28	33
Produce	90	150	140	118	22	15	15	7	10	10
Salt	184	223	211	173	129	107	115	160	157	155
Sand, stone, etc	5,978	257	50	550	440	480	1,082	882	1,887	6,302
Sheep	134	138	121	141	63	36	13	9	3	3
Staves	70	70	73	65	40	15	.....	.....	1	.....
Stoneware	364	264	485	342	339	328	330	282	282	313
Straw	298	609	554	437	217	258	185	799	752	741
Sugar	1	18	11	8	6	4	.....	4	8	72
Timber	1,861	.....	.....	22	.....	.....	.....	.....	2	22
Wheat	300	446	448	418	354	310	201	147	173	154
Wool	5	2	1	1	1	1	.....	.....	.....	.....
Total	29,305	26,277	25,392	21,819	10,120	9,405	8,695	21,623	24,028	29,618
Passengers	30,898	22,231	19,401	10,965	3,028	2,797	3,308	20,745	26,872	43,978

List of steamboats (stern-wheel) plying on the Muskingum River between Zanesville and Marietta, Ohio.

Name of steamer.	Length.	Breadth.	Depth.	Draft.	Tonnage.
	Feet.	*Feet.*	*Feet.*	*Inches.*	
Lorena	141	32	5	24	287
Sonoma	125	20	3½	23	116
Valley Gem	125	26½	4	24	156
Vega	104	17½	4	26	90
Excel[a]	110	18	3	24	100
Helen White[a]	170	32	5	24	300
T. N. Barnsdell[a]	130	22	4	24	150
Mary H.[a]	100	19	3	20	90
Jewel[a]	120	23	3	18	100
Genevia[a]	60	20	4	24	40
Nellie Walton[a]	125	30	5	36	200
Scout[a]	110	20	4	24	150
Pioneer City[a]	100	35	4	24	100
Rival[a]	150	28	4½	36	175
Ruth[a]	140	26	3	24	175
Gleaner[a]	225	43	5	48	350
Frank Tyler[a]	100	20	3	24	100
P. M. Pfeil[a]	120	24	4	36	125
Valley Belle[a]	130	22	3½	24	125
Greenwood[a]	191	38	5	36	350
T. M. Pate[a]	140	26	4	30	140
Darling[a]	120	24	4	36	125
Pacific No. 2[a]	195	40	5	48	300
Volunteer[a]	180	38	4½	36	250
Bernadina King[a]	100	18	2½	30	100

[a] Only occasional trips.

List of steamboats plying on the Muskingum River between Zanesville and Dresden, Ohio.

Name of steamer.	Length	Breadth.	Depth.	Draft.	Tonnage.
	Feet.	*Feet.*	*Feet.*	*Inches.*	
Gold[a]	90	16	2	12	40
Outing[b]	47	9	4	30	6
Kill Kare[b]	35	6	3	30	3
Gadabout[b]	21	4½	2½	22	2
Muskingum[b]	18	4	2	12	1
England[b]	16	4	2	12	1
Janette[b]	16	4	2	12	1
Betty[b]	20	5½	2½	30	2
Alice[b]	18	5	2½	20	2
Bay Lee[b]	18	4½	2	18	2
Uarda[b]	49	16	2½	18	12

[a] Packet from Zanesville to Dresden, Ohio. [b] Pleasure boats.

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List of gasoline towboats and pleasure boats plying on the Muskingum River, in pool above Marietta, Ohio.

Name of boat.	Character.	Length.	Beam.	Draft.
		Feet.	*Feet.*	*Inches.*
Elanore	Towboat	90	14	24
Annie M. Shaw	do	60	12	20
Shifter	do	40	13	24
Hustler	do	35	14	24
Helen W	do	40	12	24
Calhoun	do	65	12	24
Marietta	Pleasure boat	40	12	36
Truscott	do	16	4	24
Laken	do	18	4	24
Bessie	do	12	3	24
Earl	do	14	4	30
Ada	do	24	6	36
Nixon	do	35	8	36
Freda	do	18	6	30
Racine	do	20	5	24
Lillian	do	14	3	18
Booth	do	26	5	30
Titley	do	14	5	24
Arthur D	do	16	4	24
Missen	do	18	5	30
Belle B	do	16	5	18
Ethel	do	40	8	24

G G 3.

IMPROVEMENT OF BIG SANDY RIVER, WEST VIRGINIA AND KENTUCKY.

A statement of the original condition, projects, etc., will be found in the summary.

The United States has built 3 locks and 3 movable dams on the main river. They are designated as Nos. 1, 2, and 3, and are located at Catlettsburg, Ky., at the mouth of the Big Sandy, at Kavanaugh, Ky., 13 miles above the mouth, and at Louisa, Ky., 26 miles above the mouth, and just below the junction of the forks. The present project provides for 18 more, extending slack water improvement to the mouth of Pond Creek (just above Williamson, W. Va.), on the Tug Fork, and to Pikeville, Ky., on the Levisa Fork, 58 miles and 88.5 miles by water above Louisa, respectively.

Of the 18 locks still provided for by the project, 2 locks are being built, one on each fork, next above their junction. These locks will be known as Lock No. 1, Tug Fork, and Lock No. 1, Levisa Fork. They are located near Saltpeter, W. Va., on the Tug Fork, and at Chapman, Ky., on the Levisa Fork, about 3.7 and 8 miles, respectively, above Louisa. The Norfolk and Western Railroad has a station at Saltpeter, and the Chesapeake and Ohio Railroad has a station at Chapman.

Under the allotments for preliminary work and subsequent appropriations the following work has been accomplished during the year:

At Lock and Dam No. 1, Catlettsburg, Ky.—Good progress has been made on this work, the lock being already built, and the dam completed during the year. Some paving is still required on the lock site for full protection.

The items of work done during the fiscal year by the Sheridan Kirk Contract Company, resulting in the completion of the dam, are as below. The final estimate for this work was made in October, 1904.

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Classification.	Quantities.	Price.	Amount.
Riprap ..... cubic yards	341	$2.00	$682.00
Earth excavation ..... do	2,943	.42	1,236.06
Rock excavation ..... do	30	2.00	60.00
Bolt holes in rock or masonry ..... linear feet	366	.40	146.40
Concrete ..... cubic yards	2,205	5.00	11,025.00
Timber in permanent work ..... feet B. M.	23,580	60.00	1,414.80
Ironwork ..... pounds	233,161	.065	15,155.47
Embankment ..... cubic yards	568	.50	284.00
Square paving ..... square yards	990	3.00	2,790.00
Rough paving ..... do	411	2.50	1,027.50
Removal of old lock cofferdam (for the whole work)		500.00	500.00
Wier cofferdam (for the whole work)			4,741.92
Total			39,063.15

Under contract dated May 25, 1903, the Atlas Portland Cement Company delivered 1,700 barrels of Portland cement, completing their contract, with 5,000 barrels delivered.

At Lock and Dam No. 2, Kavanaugh, Ky.—Fair progress has been made on this work, the lock being already built and the dam completed during the year. The contractor (E. Brown Baker) exceeded the time allowed for the completion of the dam by three and one-half days, finishing the work on May 7, 1905. He was charged $6.42, expenses of superintendence, as provided in the contract.

The items of work done during the fiscal year by the contractor, E. Brown Baker, resulting in the completion of the dam and bank protection, are as below (final estimate was made May 10, 1905):

Classification.	Quantities.	Price.	Amount.
Piling, round ..... linear feet	1,847.5	$0.75	$1,385.63
Cofferdams (whole work)		13,000.00	13,000.00
Riprap, furnished and placed ..... cubic yards	831	1.00	831.00
Earth excavation ..... do	16,977	.40	6,790.80
Rock excavation ..... do	2,238	3.00	6,714.00
Bolt holes in rock and masonry ..... linear feet	1,617	.50	808.50
Concrete ..... cubic yards	2,905	6.00	17,430.00
Timber in permanent work ..... feet B. M.	10,953	70.00	766.71
Ironwork ..... pounds	281,668	.06	16,900.08
Embankment ..... cubic yards	3,600	.40	1,440.00
Paving ..... square yards	3,330	2.50	8,325.00
Removal of old cofferdam of lock (for the whole work)		500.00	500.00
Total			74,891.72

Lock and Dam No. 1 were placed under "Operating and Care" on February 1, 1905, and Lock and Dam No. 2, May 10, 1905.

Under contract dated May 17, 1904, the Virginia Portland Cement Company delivered 2,700 barrels of Portland cement, completing their contract for 3,000 barrels.

A new two-story frame dwelling, with a concrete foundation, was completed during the year at the site of Lock No. 2. This was built by hired labor and the purchase of materials, at a total cost of $3,200, $3,200 having been allotted for its construction. The dwelling is now occupied by the lockmaster.

Improving mouth of Big Sandy River.—The river and harbor act of March 3, 1905, contains the following item:

Improving Big Sandy River and Tug and Levisa forks, West Virginia and Kentucky: For maintenance and for improving the mouth of the Big Sandy River, forty-three thousand dollars.

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(See also Annual Report of the Chief of Engineers for 1904, Part 3, pp. 2637–2638.)

Of the $3,000 for maintenance, $2,000 will be expended upon Levisa Fork and $1,000 upon the Tug Fork. An item of $1,000 for maintenance of the main river is included in the annual estimate for "Operation and Care of Locks and Dams on Big Sandy River." The following is a brief description of the three locks and dams already completed:

Item.	No. 1.	No. 2.	No. 3.
When commenced	1901	1901	1883.
When completed	1904	1905	1897.
Lock walls and dam foundations	Concrete	Concrete rock	Stone, concrete.
Underlying material	Rock	Rock	Rock.
Lock gates, material, type	Mitering steel	Mitering steel	Mitering wood.
Trestles and wickets, material	Steel	Steel	Steel.
Lock chamber, size	192 by 55 feet	192 by 55 feet	190 by 52 feet.
Valves, number and type	8, cylindrical	8, cylindrical	10, balanced.
Valves, where located	Walls	Walls	2 walls, 2 gates.
Gates, how operated	Hand	Hand	Hand.
Type of pass, and length	Poirée, 140-foot needles.	Poirée, 140-foot needles.	Poirée, 130-foot needles.
Type of weir, and length	Chanoine wickets, 160 feet.	Chanoine wickets, 160 feet.	Poirée, 140-foot needles.
Dam, how operated	Derrick boat	Derrick boat	Derrick boat.
Elevation of miter sills	Both 489.5	Both 506 feet	U. 518.81 feet. L. 516.81 feet.
Elevation of top of lock walls	516.5 feet	529 feet	538.1 feet.
Elevation of pass sill	494 feet	506.6 feet	517.56 feet.
Elevation of weir sill	501.5 feet	513.1 feet	523.56 feet.
Pool level	512 feet	524.6 feet	530.7 feet.
Length of pools	12.7 miles	13.5 miles	31 miles.
Miles from Ohio River	0.3 mile	13 miles	26.5 miles.
Number of operatives	3	3	8.

NOTE.—Crest of Dam No. 3 to be raised to 535.2 feet.

Improvement of Tug and Levisa forks.—For a statement of the object of the improvement of the forks, see Annual Report of the Chief of Engineers for 1904, page 2638. The lines of both forks are now paralleled up to and beyond the heads of the proposed slack-water systems by two large and important railroads doing a large freight business. The Norfolk and Western Railroad (new main line) runs parallel to the Tug Fork, and the Chesapeake and Ohio Railroad runs parallel to the Levisa Fork. Both of these lines have been only recently completed.

Under the allotments for preliminary work and subsequent appropriations the following work has been accomplished during the year:

At Lock No. 1, Tug Fork, near Saltpeter, W. Va.—The necessary site for the construction of the lock and dam has been acquired at a total cost of $4,114.35. A contract for the construction of the lock was entered into March 10, 1905, with the Hollerbach & May Contract Company, of Evansville, Ind. The lock will be on the Kentucky side of the fork, which here forms the boundary between the States of West Virginia and Kentucky. The contractors' floating plant arrived April 24, and active operations were begun. The work has progressed very satisfactorily under generally favorable conditions. The lock, cofferdam, and protection works have been completed, also the culvert, and a large amount of excavation has been done. The contractors are about ready to begin concrete work. The

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items of work done during the fiscal year on this contract are as below:

Classification.		Quantities.	Price.	Amount.
Piling	linear feet	6,376.0	$0.40	$2,550.40
Cofferdam timber	feet B. M.	124,500.0	60.00	7,470.00
Riprap	cubic yards	428.0	1.50	642.00
Earth excavation	do	23,570.0	.50	11,785.00
Solid rock excavation	do	5.0	.50	2.50
Vitrified pipe culvert	linear feet	372.0	5.50	2,046.00
Skilled labor	hours	361.5	.25	90.37
Unskilled labor	do	477.0	.15	71.55
Total				24,657.82

At Lock No. 1, Levisa Fork, Chapman, Ky.—The necessary site for the construction of the lock and dam has been acquired at a total cost of $2,148.05. A contract for the construction of the lock was entered into March 9, 1905, with the Baker Contract Company, of Pittsburg, Pa. The contractors began work, clearing the site on March 15, 1905. Fair progress has been made. The work has been somewhat delayed by high water, but conditions on the whole have been favorable. The cofferdam for the lock is completed. The items of work done during the fiscal year on this contract are as below:

Classification.		Quantities.	Price.	Amount.
Piling	linear feet	1,799	$0.50	$899.50
Cofferdam timber	M feet B. M.	55,441	50.00	2,772.05
Riprap	cubic yards	298	2.00	596.00
Earth excavation	do	9,984	.30	2,995.20
Skilled labor	hours	176	.25	44.00
Unskilled labor	do	543	.15	81.45
Total				7,388.20

A contract was entered into with the Alma Cement Company, of Wellston, Ohio, on June 5, 1905, for furnishing 16,800 barrels of American Portland cement to be used in the construction of Locks No. 1, Tug and Levisa forks. The cement will be tested at the company's works in Wellston, Ohio, and accepted cement placed in bins and sealed. Shipments to the lock sites will be made from the sealed bins under the supervision of a United States inspector.

An examination of the Levisa Fork was made during the year, and the presence of snags and overhanging trees reported.

The construction of the two locks on the forks will be followed by that of the dams as soon as money is appropriated for that purpose. No benefit will result from the improvement until the dams are completed. One double and one single dwelling for the lock master and two assistants will be needed at each site. Approximate cost, $7,500. The sites of the two locks now being built were selected with a view to raising the crest of the dam at Louisa 4.5 feet. The approximate cost of this work is $50,000, and its completion should properly antedate that of the two dams, as it is needed in order that the full benefit of these improvements may be realized. Extensive repairs to the movable parts of the dam at Louisa have been avoided, as the contemplated reconstruction will necessitate new movable parts throughout. As a consequence the dam is now very much weakened. The trestles are badly corroded, especially in the weir, and the needles are old and many of them rotten. The dam, however, is believed to be capable

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at present of sustaining the static pressure it is called upon to bear, but a shock in addition thereto might be sufficient to wreck the movable portions of the dam. If the present structure is to stand much longer, extensive repairs to the trestles will be required. Since the completion of Dam No. 2 the lift of Dam No. 3 is 6.1 feet. One large coal company, located on the Levisa Fork below Chapman, is awaiting the raising of the Louisa dam in order to commence extensive coal operations. At present there is not water enough to float their barges.

A statement of the original condition of the Levisa and Tug forks will be found in the Annual Report of the Chief of Engineers for 1901, pages 493–494. No snagging operations were carried on upon either of the forks during the year, and their condition is much the same as at the time of the last annual report. (See Annual Report of the Chief of Engineers for 1904, pp. 2639 and 2640.)

Money statement.

July 1, 1904, balance unexpended		$285,365.31
Amount appropriated by river and harbor act approved March 3, 1905		43,000.00
Amount appropriated by sundry civil act approved March 3, 1905		85,000.00
		413,365.31
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$163,010.76	
For maintenance of improvement	42.25	
		163,053.01
July 1, 1905, balance unexpended		250,312.30
July 1, 1905, outstanding liabilities		2,802.54
July 1, 1905, balance available		247,509.76
July 1, 1905, amount covered by uncompleted contracts		188,634.30
Amount (estimated) required for completion of existing project		3,980,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	[a]$40,000.00	
For maintenance of improvement	3,000.00	
		43,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

APPROPRIATIONS.

July 18, 1878	$12,000.00	June 6, 1900 (allotted)	$2,000.00
March 3, 1879	12,000.00	March 3, 1901	140,000.00
June 14, 1880	55,000.00	June 13, 1902	178,000.00
March 3, 1881	50,000.00	March 3, 1903	50,000.00
August 2, 1882	25,000.00	March 3, 1905 (river and harbor)	43,000.00
July 5, 1884	50,000.00	March 3, 1905 (sundry civil)	85,000.00
August 5, 1886	30,000.00	Amount received from other sources in previous years	1,704.88
August 11, 1888	31,500.00		
September 19, 1890	36,000.00		
July 13, 1892	55,000.00		
August 18, 1894	45,000.00		
June 3, 1896	33,000.00		
March 3, 1899	52,500.00	Total	1,266,704.88
June 6, 1900	280,000.00		

[a] For continuing contract work authorized by river and harbor act approved June 13, 1902.

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ABSTRACT OF CONTRACTS IN FORCE ON BIG SANDY RIVER DURING THE FISCAL YEAR ENDING JUNE 30, 1905.

Contract for furnishing Portland cement (Lehigh brand) for Locks Nos. 1 and 2, Big Sandy River, West Virginia and Kentucky.

Name of contractor: Lehigh Portland Cement Company.
Date of approval: March 28, 1901.
Date of beginning: First consignment to be ordered for delivery on or about April 30, 1901.
Date of expiration: Contingent upon progress of the work; to expire by limitation on June 1, 1902.

[NOTE.—This contract has been practically completed, all cement having been delivered and all payments made with the exception of $480.05 retained percentage, which is being held in view of a possible claim against the United States for damages by the Evansville Contract Company, account of delay in delivery of cement on time.]

Item.	Contract price.
LEHIGH PORTLAND CEMENT.	
Delivered at Catlettsburg, Ky. (4,000 barrels minimum; 10,000 barrels maximum)—	
In standard paper bags, per barrel	$1.45
In barrels, do	1.63
Delivered at Wrights, Ky. (6,000 barrels minimum; 12,000 barrels maximum)—	
In standard paper bags, per barrel	1.56
In barrels, do	1.75

Contract for constructing Dam No. 1, with abutment and protection, Big Sandy River, West Virginia and Kentucky.

Name of contractor: Sheridan-Kirk Contract Company.
Date of approval: April 18, 1903.
Date of beginning and date of expiration: Concrete must be completed within one hundred fair working days, Sundays excepted, after August 1, 1903; remaining work within sixty fair working days after the expiration of the one hundred days above specified.

Item.	Contract price (unit rate).
Piling, round, linear foot	$0.50
Cofferdam timber, M feet B. M.	40.00
Cofferdam filling, cubic yard	.70
Riprap, do	2.00
Earth excavation, do	.42
Rock excavation, do	2.00
Bolt holes in rock or masonry, linear foot	.40
Concrete, cubic yard	5.00
Timber in permanent work, M feet B. M.	60.00
Ironwork, pound	.05½
Embankment, cubic yard	.50
Puddling, do	3.00
Square paving, square yard	3.00
Rough paving, do	2.50
Removal of old cofferdam of lock, whole work	500.00

Completed.

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Contract for furnishing about 5,000 barrels Atlas Portland cement at Catlettsburg, Ky., for use at Dam No. 1, Big Sandy River, West Virginia and Kentucky.

Name of contractor: Atlas Portland Cement Company.
Date of approval: May 25, 1903.
Date of beginning: When ordered (par. 37).
Date of expiration: Depending upon progress of construction work (see par. 37).

Item.		Contract price.
About 5,000 barrels Atlas Portland cement, delivered at Catlettsburg, Ky	barrel	[a] $2.46

[a] Rebate of 10 cents allowed for each empty bag returned to point of delivery.

Completed.

Contract for constructing Dam No. 2, with bank protection, Big Sandy River, West Virginia and Kentucky.

Name of contractor: E. Brown Baker.
Date of approval: March 17, 1904.
Date of beginning and date of expiration: Concrete must be completed within one hundred fair working days, Sundays excepted, after August 1, 1904; remaining work within sixty fair working days after the expiration of the one hundred fair working days above specified.

Item.		Contract price (unit rate).
Piling, round	linear foot	$0.75
Cofferdams	whole work	13,000.00
Riprap, furnished and placed	cubic yard	1.00
Riprap, placed	do	1.00
Earth excavation	do	.40
Rock excavation	do	3.00
Bolt holes in rock or masonry	linear foot	.50
Concrete	cubic yard	6.00
Timber in permanent work	M feet B. M.	70.00
Ironwork	pound	.06
Embankment	cubic yard	.40
Paving	square yard	2.50
Removal of old cofferdam of lock	whole work	500.00

Completed.

Contract for furnishing Portland cement (Old Dominion brand) for Dam No. 2, Big Sandy River, West Virginia and Kentucky.

Name of contractor: Virginia Portland Cement Company.
Date of approval: May 17, 1904.
Date of beginning: June 3, 1904, if so ordered.
Date of expiration: Season of 1904 or 1905, depending upon progress of work.

Item.		Contract price.
2,500 barrels American Portland cement, delivered f. o. b. cars Kavanaugh, Ky., in cotton bags	per barrel	$1.75
Rebate allowed on empty bags returned	per bag	.10

Completed.

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Contract for building Lock No. 1, Levisa Fork of Big Sandy River, West Virginia and Kentucky.

Name of contractor: Baker Contract Company.
Date of approval: March 23, 1905.
Date of beginning: Delivery of material must begin within thirty days after receipt of notice of approval of contract.
Date of expiration: January 1, 1907.

Item.		Contract price (unit rate).
Piling	linear foot	$0.50
Cofferdam timber	M feet B. M.	50.00
Riprap	cubic yard	2.00
Rock excavation	do	2.00
Earth excavation	do	.30
Embankment	do	.50
Puddling	do	2.00
Concrete	do	4.25
Pivot stones	piece	40.00
Timber in permanent work	M feet B. M.	80.00
Iron and steel	pound	.06

Contract for building Lock No. 1, Tug Fork of Big Sandy River, West Virginia and Kentucky.

Name of contractor: The Hollerbach & May Contract Company.
Date of approval: April 10, 1905.
Date of beginning: Delivery of material must begin within thirty days after receipt of notice of approval of contract.
Date of expiration: January 1, 1907.

Item.		Contract price (unit rate).
Piling	linear foot	$0.40
Cofferdam timber	M feet B. M.	60.00
Riprap	cubic yard	1.50
Earth excavation	do	.50
Loose rock excavation	do	.50
Solid rock excavation	do	.50
Embankment	do	.20
Concrete	do	4.00
Pivot stones	per piece	50.00
Timber in permanent work	feet B. M.	60.00
Iron and steel	pound	.04
Vitrified-pipe culvert	linear foot	5.50
Concrete culvert	do	5.50

Contract for furnishing and delivering American Portland cement for use in the construction of Lock No. 1, Tug Fork, and Lock No. 1, Levisa Fork, of Big Sandy River, West Virginia and Kentucky.

Name of contractor: Alma Cement Company.
Date of approval: June 21, 1905.
Date of beginning and date of expiration: Cement will be delivered as required in lots from one to eight carloads each. If the work of construction proceed as is now expected, the entire amount of cement will be needed during the working season of 1905; but deliveries must be made only upon orders from the engineer, and it is possible that the contract may not be completed until the season of 1906.

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Item.	Contract price (unit rate per barrel in bags).
ALMA PORTLAND CEMENT.	
9,700 barrels, in cloth bags, delivered f. o b., Saltpeter, W. Va., for Lock No. 1, Tug Fork	[a] $1.85
7,100 barrels, in cloth bags, delivered f. o. b., Chapman Station, Ky., for Lock No. 1, Levisa Fork	[a] 1.87

[a] Rebate of 10 cents allowed for each empty bag returned to point of delivery.

COMMERCIAL STATISTICS.

Big Sandy River, West Virginia and Kentucky, including Tug and Levisa forks, for calendar year ending December 31, 1904, and prior years.

Articles.	1899.	1900.	1901.	1902.	1903.	1904.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Timber	210,000	200,000	260,000	250,000	134,085	98,459
Hides	73	.....	34	15	22	297
Leather	.....	.....	1	1	3	1
Lumber	.....	.....	13,000	93	879	862
Produce	13,300	15,000	9,000	6,000	52	30
Live stock	1,149	2,000	235	726	494	139
Spokes	.....	.....	10	55	1,763	1,108
Staves	452	1,000	3,480	1,720	1,604	.....
Tan bark	.....	.....	550	35	.....	.....
Ties	48,000	50,000	44,000	44,067	123,260	33,352
Grain	609	500	154	195	1,674	867
Wool	.....	.....	2	2	2	1
Miscellaneous	69,820	29,000	19,000	47,614	26,017	16,718
Passengers	2,375	2,500	396	412	1,096	243
Total	345,778	300,000	349,862	350,935	290,401	152,077

No new lines of transportation have been established.

List of boats plying Big Sandy River, West Virginia and Kentucky, and Tug and Levisa forks of same.

Name of boat.	Character.	Length.	Breadth.	Depth.	Tonnage.
		Feet.	*Feet.*	*Feet.*	
Sea Gull	Side wheel	90.0	12.00	2.60	80.24
The Alka	do	116.0	19.20	3.20	45.00
Big Sandy	do	110.0	14.00	1.80	24.12
Natchez	do	82.0	8.75	1.42	12.97
Guyandotte	do	104.0	16.00	2.80	43.88
Louisa	do	90.0	9.00	2.00	.....
Dr. York[a]	Stern wheel	96.4	18.40	1.50	46.00
J. M. Grubbs	do	90.0	20.00	3.20	47.00
Donca	do	109.5	18.40	3.00	56.00
Cricket	do	132.0	18.30	2.90	51.00
Katie Mc	do	100.0	18.00	2.50	41.00
M. B. Goble	do	90.0	18.00	3.50	116.00
Vincennes	do	98.5	20.00	3.30	81.89
M. L. Thornton	do	75.0	15.00	2.80	27.00
Leni Leoti	do	90.0	18.33	2.33	75.00
Cando	do	117.5	20.00	3.00	74.00
Laynesville	Side wheel	105.0	16.00	2.50	98.01
Sea Lion	Stern wheel	123.0	22.00	3.50	127.00
Mildred Runyon	do	58.0	12.00	1.83	13.00
Monitor	.....	.....	.....	.....	.....
Gordon Nigh	Stern wheel	55.0	8.33	2.50	.....
Telephone	do	93.0	15.00	2.50	73.00
Sam A. Conner	do	98.5	16.00	1.50	68.00
Egan	.....	.....	.....	.....	.....
Crown Hill	.....	135.0	23.00	3.50	120.33
Catherine Davis	.....	135.0	26.00	3.00	337.00

[a] Burned at Kenova, W. Va., October 27, 1904.

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List of vessels, rafts, etc., passing lock and dam on Big Sandy River during the calendar year ending December 31, 1904.

Craft.	Up.	Down.	Total.
Steamboats	135	139	274
Barges and flats	36	43	79
Rafts		1,564	1,564
Ties		174,215	174,215
Miscellaneous	17	13	30

Lockages at Lock No. 3, Big Sandy River, during the calendar year ending December 31, 1904.

	Up.	Down.		Up.	Down.
January			August	9	29
February			September	11	13
March			October	3	3
April			November	7	7
May	8	11	December		
June					
July	5	8	Total	43	71

Total, 114.

G G 4.

OPERATING AND CARE OF LOCKS AND DAMS ON THE BIG SANDY RIVER, WEST VIRGINIA AND KENTUCKY.

There are three locks and three movable dams in operation on the main river. They are designated as Nos. 1, 2, and 3, and are located at Catlettsburg, Ky. (at the mouth of the river), at Kavanaugh, Ky. (13 miles above Catlettsburg, and at Louisa (just below the junction of the forks). The dates of opening are given in the summary. A brief description of all three locks and dams is given in the report of improvement of Big Sandy River, and a full description of the needle dam at Louisa (the first one of the series completed) is given in the Annual Report of the Chief of Engineers for 1897, page 2534 et seq.

The following is a statement of the maneuvers of the three dam during the fiscal year ending June 30, 1905:

Dam No. 1:
Raised November 7, 1904.
Lowered November 22, 1904.
Raised April 22, 1905.
Lowered April 24, 1905.
Dam No. 2:
None.
Dam No. 3:
Raised July 18, 1904.
Lowered December 7, 1904.

The total amount expended during the year ending June 30, 1905, was $3,822.88.

The following work has been accomplished during the year:

At Lock and Dam No. 1, Catlettsburg, Ky.—Three old houses were acquired with the site. Certain necessary repairs were made thereto during the year, including carpenter work, painting, repairs to foundations, etc. When these are completed there will be suitable quarters for the three members of the regular force. The sheds left by the

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contractors have been torn down and removed and a blacksmith shop has been built. The operating machinery of the lock and dam, being new, is not yet in perfect working order. Considerable difficulty attended the first operation of the lock and dam owing to the conditions existing at this site. The lock is on the Kentucky side of the river, and swift currents flowing through it at times of high water endanger the town of Catlettsburg below, whose banks are not adequately protected. The upper gate is therefore closed during the season of high water, and as a consequence a large deposit of sand, snags, and other drift occurs above the gate. This was removed with considerable difficulty this year. Funds are already appropriated to provide adequate protection for the bank below. When this work is completed the gates will be left open during the season of high water and deposits against them avoided (see report for improvement of Big Sandy River, summary, and pp. 2637–2638 of the Annual Report of the Chief of Engineers for 1904). The paving for bank protection at the lock site is not yet completed, and grading of the banks and repairs to the grounds and buildings are still required. Concrete gauges for the miter sills and pass sill have been made and set. A derrick boat, with hoisting engine for the operation of the dam, was completed and delivered during the year. It was built by hired labor and the purchase of materials.

At Lock and Dam No. 2, Kavanaugh, Ky.—There are two good sets of quarters at this site, furnishing dwellings for two families. One of them was completed during the year. The sheds left by the contractors have been torn down and removed and a blacksmith shop has been built. The operating machinery of the lock and dam, being new, is not yet in perfect working order. Repairs and improvements to the grounds are still required. Concrete gauges for the miter sills and pass sill have been made and set. A derrick boat, with hoisting engine for the operation of the dam, was completed and delivered during the year. It was built by hired labor and the purchase of materials.

Much of the work on these two locks during the year (outside of the contracts) has been done out of funds for improving Big Sandy River, such work being necessary to place the locks and dam in suitable condition for operation.

At Lock and Dam No. 3, Louisa, Ky.—The buildings on this site are an office and quarters (for two of the operatives of the regular force), besides smaller buildings. The grounds and buildings are in excellent condition, and present a very good appearance. During the year the paving on the lock site has been completed and affords what is believed to be absolute protection. The needles of the dam have been repaired and are now in fairly good condition. The dam is in a very weak condition, on account of rot of the needles and corrosion of the trestles, and extensive repairs, involving new movable parts throughout and a raising of the crest 4.5 feet, have been authorized, but funds are not yet available.

The derrick boat used to operate the dam is old and not very serviceable. It is recommended that it be replaced by a traveling cableway, which would furnish a safer and surer means of operating the dam. The installation of a cableway would also very materially decrease the cost of the authorized reconstruction of the dam.

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The Big Sandy River is subject to great and sudden rises, which endanger the works of improvement in the stream. Extreme watchfulness is necessary in order to protect public property from damage at such times. On account of high water in the forks it may become necessary to lower Dam No. 3 on very short notice. The release of the two pools of this dam endangers Dam No. 2, but there is no way in which word of the lowering of No. 1 can be sent in any reasonable time to the operatives of No. 2. On May 10, 1905, there was a cloudburst in the Big Sandy Valley. At No. 3 there was no perceptible rise in the river during the day. At No. 1 it rose nearly 5 feet in about forty-five minutes. An unmanageable raft went through the lock tearing loose the maneuvering boat and needles, and the loss of all the movable property was narrowly averted. Had there been any means of communication the lockmaster at No. 2 could have given warning to the lockmaster at No. 1, but he is miles away even from the nearest telegraph office. Had Dam No. 1 been up at the time the damage would probably have been great. In view of these conditions a telephone line between the different units of the slack-water system and extending up the forks is considered necessary for the safety of the works. Such a system would also save a great deal of time and money now spent in writing letters and traveling, and it would render possible a better control of the system by the engineer in local charge.

Commercial statistics are included in the report of improvement of Big Sandy River.

ALLOTMENTS.

July 23, 1897	$2,840.00	July 17, 1902	$5,075.88
July 23, 1898	3,250.95	July 18, 1903	2,677.98
July 19, 1899	3,524.28	July 11, 1904	2,950.48
July 18, 1900	3,177.09	October 31, 1904	1,650.00
July 10, 1901	3,658.12		

Summary of expenditures for operating and care of locks and dams on Big Sandy River, West Virginia and Kentucky, for the fiscal year ending June 30, 1905.

Office expenses, superintendence, and contingencies	$471.67
Labor	2,933.27
Fuel	3.25
Expenses	162.88
Repairs	251.81
Total	3,822.88

GG 5.

IMPROVEMENT OF KENTUCKY RIVER, KENTUCKY.

A statement of the condition of the river in 1879, when it was turned over to the United States by the Commonwealth of Kentucky, will be found in the Annual Report of the Chief of Engineers for 1898, pages 2012 et seq.

There are 10 locks and dams of the projected series of 14 completed, and Lock and Dam No. 11 under construction. Lock No. 11 is

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located about 1½ miles from College Hill, Ky., 200 miles from the mouth of the river. Locks 9 and 10 are temporarily out of operation on account of extensive washouts which occurred behind the land walls during March.

The locations and other information pertaining to the completed work of navigation will be found in the Annual Report of the Chief of Engineers for 1899, page 2523.

The work accomplished during the fiscal year is given below:

Lock and Dam No. 10.—The construction of this lock and dam, including lock houses and outbuildings, but not including cement, was let in one contract to the Mason & Hoge Company, of Frankfort, Ky., and work was in progress at the beginning of the year.

During the year the lock was completed, including the valves and gates, the cofferdam for the lock removed, the cofferdam for the dam constructed, and the dam and abutment built. The filling behind the lock was completed and riprapped and the bank on the abutment side graded and riprapped. The necessary part of the second cofferdam was removed; the contractors' plant dismantled and taken away, and the grounds cleared and vacated by the contractors.

The contract was completed in accordance with the specifications on January 7, and the lock and dam turned over to operating and care account on January 12, 1905.

The items of work done on this contract during the year, with contract prices and the totals of quantities and payments under it, are given in the following table:

Lock and Dam No. 10.

Kind of work and material.	Price.	Done after July 1, 1904.		Total in contract.	
		Quantities.	Cost.	Quantities.	Cost.
Cofferdam timber.....feet B M..	$35.00	138,183.00	$4,836.405	358,822.00	$12,541.27
Timber in permanent construction, feet B. M.....	50.00	17,370.00	868.50	17,370.00	868.50
Piling.....linear feet..	.40	.....	.....	1,288.00	515.20
Cofferdam filling.....cubic yards..	.50	8,530.00	4,265.00	18,189.00	9,094.50
Embankment.....do....	.35	6,996.00	2,448.60	19,304.00	6,756.40
Excavation:					
Rock.....do....	2.00	349.20	698.40	379.80	759.60
Earth.....do....	.40	2,961.20	1,172.48	40,963.69	16,378.48
Deposit.....do....	.40	33.00	13.20	33.00	13.20
Concrete.....do....	3.80	5,382.95	20,265.21	26,058.43	99,008.08
Riprap.....do....	1.50	2,288.50	3,425.25	3,331.10	4,996.65
Stone masonry.....do....	50.00	.....	.....	10.37	518.50
Driftbolts.....pounds..	.04	6,019.00	240.76	14,902.00	596.08
Iron and steel.....do....	.055	290,794.00	15,998.67	335,686.00	18,462.73
Fence.....linear feet..	.15	.....	.....	2,836.00	425.40
Dwellings.....each..	2,500.00	.....	.....	2.00	5,000.00
Outbuildings.....do....	150.00	.....	.....	2.00	300.00
Cisterns.....do....	100.00	.....	.....	2.00	200.00
Labor:					
Skilled.....hours..	.25	300.50	75.125	926.00	231.50
Unskilled.....do....	.15	230.00	34.50	1,908.33	286.50
Total cost.....	.....	.....	54,337.10	.....	176,941.54
Cost of 25¼ barrels cement damaged while in the hands of contractor.....	.....	.....	.....	.....	49.92
Leaving.....	.....	.....	.....	.....	176,891.62

The river was closed October 19, but on account of the extreme low water the pool did not fill to the crest of the dam until December 16. The amount of water running in the river was so small that the rise

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in the pool only amounted to 3.85 feet from October 19 to December 1, with no leakage whatever except the small percolations through the concrete.

The necessary cement was supplied by the United States under a contract with the Virginia Portland Cement Company for "Old Dominion" brand.

On December 18 the local office, with all its contents, including records, instruments, cement-testing outfit, etc., was destroyed by fire. Fortunately copies existed of the most important records, except records of surveys of overflowed land made in 1904.

Lock and Dam No. 11.—On September 28, 1903, a contract was entered into with H. E. Talbott & Co., of Dayton, Ohio, for the material, except cement, and the labor necessary to construct this lock and dam complete, and work was in progress under this contract at the beginning of the fiscal year. During the year the lock cofferdam was built, excavation for the lock and upper approach wall completed, excavation for lower approach wall more than half done, and the land wall, foundation for river wall, guide piers, and upper approach wall were built.

Concreting began on August 30, was suspended for the winter December 2, resumed April 20, and is now in progress. All ironwork, including gates and valves, is on the site, the embankment behind the land wall finished, and the concrete paving between the wing walls laid. The timber work in anchor cribs behind upper approach wall is completed.

Scarcity of labor, breaks in plant, and trouble with the quality of stone in the quarries have much delayed the work, although the contractors have not fallen behind the schedule suggested in the specifications.

The items of work done during the fiscal year by H. E. Talbott & Co., contractors on Lock and Dam No. 11, Kentucky River, Kentucky, are as below:

Classification.	Quantities.	Price.	Amount.
Cofferdam timber ..... M feet B. M..	169,767.00	$39.00	$6,620.913
Timber in permanent construction ..... do....	31,100.00	50.00	1,555.00
Piling ..... linear feet..	2,357.00	.40	942.80
Cofferdam filling ..... cubic yards..	7,928.00	.45	3,568.70
Embankment ..... do....	11,398.00	.40	4,557.20
Earth excavation ..... do....	40,683.30	.45	18,307.485
Rock excavation ..... do....	6.00	2.50	15.00
Deposit ..... do....	154.00	.50	77.00
Concrete ..... do....	11,119.88	4.65	51,707.209
Riprap ..... do....	857.00	1.70	1,456.90
Stone masonry ..... do....	5.93	50.00	296.50
Iron and steel ..... pounds..	77,350.00	.07	5,414.50
Drift bolts ..... do....	9,006.00	.05	450.30
Fence ..... linear feet..	8,832.00	.30	1,149.60
Skilled labor ..... hours..	237.50	.25	59.375
Unskilled labor ..... do....	1,525.50	.15	228.825
Total	.....	.....	96,405.307

Upon the whole, the contractor's plant (mentioned on p. 2645, Annual Report of the Chief of Engineers for 1904) has proved a success, especially so in regard to the cableways, although considerable delay occurred in the beginning from minor breaks and one or two more serious accidents.

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Cement was furnished by the United States under a contract with the Virginia Portland Cement Company for "Old Dominion" brand.

Surveys and claims.—The river and harbor act approved March 3, 1905, authorized the use of so much of the funds appropriated for the improvement of the river as might be necessary to repay the county court of Clark County, Ky., the reasonable cost expended by it in constructing the county bridge across Twomile Creek, in Clark County, and to repair the damage to the county road caused by the construction of Lock and Dam No. 10, at Ford, Ky. Under this authority the county court has been reimbursed for its expenditure in constructing the Twomile Creek bridge, and a survey, map, and location made for the repairs to the road around the abutment at Lock No. 10. Negotiations for the necessary land for repairing this road are now in progress.

Various claims have been made against the United States for damages to low-lying land overflowed by the pools of Locks Nos. 9 and 10. To determine the amounts and values of the land overflowed, careful surveys have been made on Tates, Otter, Twomile and Fourmile creeks. This information is requested by the Department of Justice. The surveys were completed and the maps are in course of construction. Information and map for one suit were finished and given to the district attorney, and the others will be ready for the next term of court at Richmond, Ky.

Cement.—The following table shows the amount of "Old Dominion" Portland cement furnished during the year by the Virginia Portland Cement Company, under their contract dated June 9, 1904, for furnishing cement for Locks and Dams Nos. 10 and 11:

Lock and Dam No. 10,	4,160.25 barrels, at $1.87	$7,779.66¾
Lock and Dam No. 11,	11,436.78 barrels, at 1.91	21,844.26¼
	15,597.03	29,623.93

On this contract a rebate of 40 cents per barrel is allowed upon the return of the empty bags.

It is proposed to apply available balances to the completion of Lock and Dam No. 11, and any remaining balance, together with the $91,000 additional appropriation recommended, would be available for the partial construction of Lock and Dam No. 12, if it is deemed advisable to begin this work prior to the appropriation of sufficient funds to warrant its completion.

Owing to the unexpected disasters at Locks Nos. 9 and 10, the additional cost of Lock No. 11 on account of change in plans adopted by the Kentucky River Board of Engineers and approved by the Chief of Engineers, with a view of avoiding a similar accident, will aggregate a sum equal to the cost of repairs at Lock 9 or 10.

Commercial statistics are given in the report for operating and care of locks and dams on the Kentucky River.

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Money statement.

July 1, 1904, balance unexpended	$458,443.45
Overpayment refunded	.46
Amount appropriated by river and harbor act approved March 3, 1905	50,000.00
Received from sale of property at public auction	95.50
	508,539.41
June 30, 1905, amount expended during fiscal year, for works of improvement	186,442.65
July 1, 1905, balance unexpended	322,096.76
July 1, 1905, outstanding liabilities	301.50
July 1, 1905, balance available	321,795.26
July 1, 1905, amount covered by uncompleted contracts	189,706.20
Amount (estimated) required for completion of existing project	1,885,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	[a]174,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

March 3, 1879	$100,000.00	May 1, 1900, overpayment refunded	$0.75
June 14, 1880	100,000.00	Received from O'Brien & Gulden, March 31, 1893	6,000.00
March 3, 1881	125,000.00	March 6, 1903, received from sale of condemned property	53.10
August 3, 1882	225,000.00	May 14, 1904, received from transfer of engineer property to Big Sandy River	916.75
July 5, 1884	250,000.00	Amount received from other sources in previous years	84.22
August 5, 1886	187,500.00	November 28, 1904, overpayment refunded	.46
August 11, 1888	180,000.00	December 20, 1904, received from sale of condemned property	95.50
September 19, 1890	180,000.00	Total	2,988,150.98
July 13, 1892	150,000.00		
August 18, 1894	125,000.00		
June 3, 1896	50,000.00		
June 3, 1896	83,000.00		
June 4, 1897	200,000.00		
July 1, 1898	350,000.00		
June 6, 1900	75,000.00		
March 3, 1901	150,000.00		
June 28, 1902	200,000.00		
March 3, 1903	200,000.00		
March 3, 1905	50,000.00		
Received from Tabor & Cogar, October, 1888	500.00		
July 13, 1899, overpayment refunded	.20		

[a] Balance authorized by river and harbor act of June 3, 1896, and sundry civil act of June 4, 1897.

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ABSTRACT OF CONTRACTS IN FORCE ON KENTUCKY RIVER, KENTUCKY, DURING THE FISCAL YEAR ENDING JUNE 30, 1905.

Contract for constructing Lock and Dam No. 9, Kentucky River, Kentucky.

Name of contractor: The Sheridan-Kirk Contract Company.
Date of approval: June 12, 1901.
Date of beginning: July 15, 1901.
Date of expiration: June 15, 1903. Extended to December 15, 1903.

NOTE.—This contract was modified with respect to construction of cofferdams, supplementary contract dated April 21, 1903; approved May 11, 1903.

Item.		Contract price (unit rate).
Ballast	cubic yard	$1.50
Cofferdam filling	do	.50
Cofferdam timber	M feet B. M.	35.00
Concrete	cubic yard	8.90
Deposit	do	.50
Driftbolts	pound	.08½
Excavation:		
Earth	cubic yard	.40
Rock	do	8.00
Embankment	do	.35
Fence in place	linear foot	.25
Hauling cement:		
If delivered by rail	barrel	.07
If delivered by water	do	.07
Iron and steel	pound	.04½
Masonry	cubic yard	50.00
Paving:		
If concrete	square yard	1.75
If stone	do	2.75
Piles	linear foot	.50
Timber in permanent construction	M feet B. M.	42.00
Valves	set	500.00
Winches	do	100.00

Completed.

Contract for building Lock and Dam No. 10, etc., Kentucky River, Kentucky.

Name of contractor: Mason & Hoge Company.
Date of approval: June 30, 1902.
Date of beginning: August 3, 1902.
Date of expiration: August 3, 1905.

Item.		Contract price (unit rate).
Cofferdam timber	M feet B. M.	$35.00
Timber in permanent construction	do	50.00
Piling	linear foot	.40
Cofferdam filling	cubic yard	.50
Embankment	do	.35
Excavation:		
Earth	do	.40
Rock	do	2.00
Deposit	do	.40
Concrete	do	8.80
Riprap	do	1.50
Stone masonry	do	50.00
Iron and steel	pound	.05½
Driftbolts	do	.04
Fence	linear foot	.15
Dwellings	each	2,500.00
Outbuildings	do	150.00
Cisterns	do	100.00

Completed.

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Contract for building Lock and Dam No. 11, Kentucky River, Kentucky.

Name of contractor: H. E. Talbott & Co.
Date of approval: October 19, 1903.
Date of beginning: November 21, 1903.
Date of expiration: January 1, 1907.

Item.		Contract price (unit rate).
Cofferdam timber	M feet B. M.	$30.00
Timber in permanent construction	linear foot	50.00
Piling	do	.40
Cofferdam filling	cubic yard	.45
Embankment	do	.40
Earth excavation	do	.45
Rock excavation	do	2.50
Deposit	do	.50
Concrete	do	4.65
Armored concrete, exclusive of steel	do	4.95
Riprap	do	1.70
Rough paving	do	1.70
Stone masonry	do	50.00
Iron and steel	pound	.07
Driftbolts	do	.05
Fence	linear foot	.30
Tile drain	do	.50

Contract for furnishing about 15,000 barrels American Portland cement (Old Dominion brand) at Ford, Ky., and Richmond or Moberly, Ky., for use in the completion of Lock and Dam No. 10 and in the construction of Lock and Dam No. 11, Kentucky River, Kentucky.

Name of contractor: Virginia Portland Cement Company.
Date of approval: June 28, 1904.
Dates of beginning and expiration: The cement must be delivered as required in lots of from 1 to 8 carloads each within fifteen days after receipt of order. If not completed in 1904, the contract will continue in effect during season of 1905.

Item.		Contract price.
American Portland cement, Old Dominion brand (7,500 barrels minimum, 22,500 barrels maximum), delivered at Ford, Ky., and Richmond or Moberly, Ky.:		
In bags, at Ford, Ky	barrel	$1.87
In bags, at Richmond, Ky	do	1.91
In bags, at Moberly, Ky	do	1.98
Rebate allowed on empty bags returned	per bag	.10

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OPERATING AND CARE OF LOCKS AND DAMS ON KENTUCKY RIVER, KENTUCKY.

Information in regard to location of Locks and Dams Nos. 1 to 8 may be found in the Annual Report of the Chief of Engineers for 1899, page 2523. Reference is also made to page 2012 et seq. of Annual Report of the Chief of Engineers for 1898, in which the condition of the Kentucky River is described in 1879, when ceded to the United States by the Commonwealth of Kentucky.

Ten locks and dams have been opened to navigation on the Kentucky River. Lock No. 9, opened December 3, 1903, is 17.4 miles above Lock No. 8, and 157.2 miles from the Ohio River, and Lock No. 10 January 12, 1905, 18.8 miles above Lock No. 9, and 176½ miles from

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the Ohio River, giving a total of 200 miles of slack-water navigation in this system. Lock No. 11 is in progress of construction.

On March 12–13, 1905, a washout occurred around Locks Nos. 9 and 10, rendering these locks practically useless until necessary repairs are made. All navigation since these dates have passed through gaps around lock walls.

All locks have been in operation during the fiscal year except as noted:

Lock No. 1: 36 days by ice; 26 days by freshets and high water from Ohio River; 1½ days repairing lower gates. Total number of days, 63½.
Lock No. 2: 35 days by ice; 5 days by high water; 22 days constructing new concrete miter sill in lower entrance. Total number of days, 62.
Lock No. 3: 34 days by ice; 4 days by high water. Total number of days, 38.
Lock No. 4: 31 days by ice; 3 days by high water. Total number of days, 34.
Lock No. 5: 31 days by ice; 4 days by high water. Total number of days, 35.
Lock No. 6: 31 days by ice; 3 days by high water. Total number of days, 34.
Lock No. 7: 31 days by ice; 4 days by high water. Total number of days, 35.
Lock No. 8: 35 days by ice; 3 days by high water. Total number of days, 38.
Lock No. 9: 33 days by ice; 60 days drawn to assist in construction of Dam No. 10; not operated since March 12, 1905. Total number of days, 203.
Lock No. 10: 33 days by ice; not operated since March 12.

The highest stage of water was on March 11, 1905, the upper gauge at Lock No. 4 reading 20.4 feet, or 14.8 feet above pool level.

The lowest stage of water was in November and December, 1904, the upper gauge at Lock No. 4 reading 4.1 feet. An extreme drought occurred during this period.

A depth of 6 feet at pool stage exists at the close of the fiscal year on the river from Lock No. 1 to Lock No. 9, except in the lower entrance at Lock No. 2, where there is 5.85 feet, and on the upper miter sill at Lock No. 4, where there is scant 5.6 feet. The coffer in lower entrance at Lock No. 2, used in construction of concrete miter sill, has not yet been removed.

The Kentucky River is now navigable to Lock No. 9, near Valleyview, Ky., 157.2 miles from the Ohio River.

A statement of the work accomplished during the fiscal year is as follows:

Lock No. 1.—Two hundred and fourteen linear feet of the old lower land crib was torn down and removed to elevation of 4.4 feet, where the old crib timbers were found to be sound. On this foundation isolated concrete piers were built. These piers are connected by timber walks, and places were left in the concrete for grillage plank between piers, but as yet these have not been put in. Eight hundred and fifty-seven cubic yards of concrete were placed in this work.

A concrete saddle was also constructed to raise the crest of the dam 1 foot for a distance of about 125 feet from the abutment.

Minor repairs were also made to dam, and concrete steps were built from lock wall to office.

Lock No. 2.—On June 8, 1905, navigation at this lock was suspended in order to replace the old wooden miter sill with a concrete sill. A cofferdam has been built in the lower entrance to lock chamber, and the concrete for the sill has been placed, but owing to a rise in the river on the 24th of June, which flooded the cofferdam, the sill timbers have not been laid, and work has been suspended until the coffer can be pumped out.

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Lock No. 4.—The work of constructing isolated piers for lower land approach wall, which was begun during the last fiscal year, was completed. These piers are similar to the piers at Lock No. 1, and are connected by timber walks. Four hundred and forty-five cubic yards were used in this work. A kitchen to lockman's house was built and the lock houses painted.

Lock No. 5.—The lower river crib was removed to low water, where the timbers were found to be sound, and on this foundation isolated piers of concrete were built similar to the piers at Locks Nos. 1 and 4. These piers were not quite finished. Four hundred and twenty-three cubic yards of concrete have been placed and there remains about 100 yards more to be put in.

Lock No. 7.—Lock houses and office building were painted and rooms calcimined.

Lock No. 9.—The down stream face and crest of the concrete dam was considerably battered by the logs during the high water of two winters ago. (See Report of the Chief of Engineers for 1904, p. 2650.) The holes and spaces torn out were repaired by cutting these out and putting in bolts, so as to make a good bond, and filling in with rich concrete.

During a rise in the river in March, when the water rose to a height of about 4 feet over the lock walls at the upstream end, the embankment behind the lock wall washed out.

It is now proposed to repair this lock and crib timber and materials are being received. A quarry has been opened up on the abutment side above the dam and a cut 30 feet back of abutment has been made, thus increasing the spillway of the dam. About 3,000 cubic yards of crib stone have been quarried.

Lock No. 10.—During February and March a temporary crib, (grain-elevator construction) was built below abutment to protect the bank and prevent the water from cutting around abutment. This crib was 85 feet long, 18 feet high, and 12 feet wide and was filled with riprap stone.

On March 13 the river rose to about 4 feet over the top of the lock walls at the upstream end and washed out the embankment filling behind lock walls. One lock house was washed away, but the lower house was moved back and is at present resting on blocking.

U. S. towboat Gen'l O. M. Poe.—The U. S. towboat *Gen'l O. M. Poe* was transferred to Col. G. J. Lydecker, Corps of Engineers, U. S. Army, Cincinnati, Ohio, on July 1, 1904, and returned to operating and care of Kentucky River on September 5, 1905, when the boat was placed out of commission and placed in charge of a watchman. The *Poe* was again put in commission on February 11, 1905, and has been engaged in general towing and repair work, with the exception of a few weeks when repairs were made to wheel and cylinder frames at Frankfort, Ky.

Towboat John Mackey.—The towboat *John Mackey* was chartered at various times during the year for general towing and acted as tender to dredges and scows.

Towboat Louise.—The towboat *Louise* was chartered during July and August, 1904, and used to tow derrick boat and quarter boat in snagging operations from Lock No. 1 to 9.

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U. S. dredges Nos. 1 and 2.—Both dredges have been actively engaged during the working season in dredging and assisting in work of reconstruction at Locks Nos. 1, 2, 4, 5, and 9.

Dredge *No. 1* has operated at Sharps Branch, Cedar Run, Maceys riffle, lower entrance to Lock No. 8, Marble Creek, and at Lock No. 9. Approximate amount of material excavated, 51,300 cubic yards.

Dredge *No. 2* has assisted in the repair work at Locks Nos 1, 2, and 5 and removed deposit in lock entrances.

United States fleet.—Extensive repairs have been made to floating crafts—4 barges and 2 side-dump scows have been practically rebuilt from bottom timber up with Oregon fir. The work was done at the Madison Marine Ways, Madison, Ind.

ALLOTMENTS.

July, 1884	$15,000.00	July 15, 1898	$53,531.39
July, 1885	27,615.00	July 29, 1899	63,884.24
July 31, 1886	33,965.00	May 11, 1900	2,500.00
July, 1887	79,862.14	July 17, 1900	82,284.09
July, 1888	82,478.50	July 9, 1901	109,137.49
July 28, 1889	72,394.80	August 19, 1901	952.00
July 17, 1890	28,889.07	February 4, 1902	19,000.00
July 16, 1891	36,331.38	July 22, 1902	79,634.91
November 28, 1891	1,112.50	July 20, 1903	56,971.61
December 14, 1891	11,382.80	July 13, 1904	56,953.04
July 15, 1892	38,503.62	May 18, 1905	10,000.00
June 13, 1893	2,000.00	Received from other sources in this and previous years	189.05
July 14, 1893	73,065.02		
July 16, 1894	46,435.28		
July 20, 1895	59,120.04		
July 24, 1896	70,198.85		
August 2, 1897	49,272.11	Total	1,262,663.93

Summary of expenditures for operating and care of locks and dams on Kentucky River, Kentucky, for fiscal year ending June 30, 1905.

Office expenses, superintendence, and contingencies	$8,095.93
Labor	38,262.43
Fuel	3,143.99
Expenses	7,440.78
Repairs	32,260.29
Total	89,203.42

ABSTRACT OF CONTRACTS IN FORCE, OPERATING AND CARE, KENTUCKY RIVER, DURING THE FISCAL YEAR ENDING JUNE 30, 1905.

Contract for furnishing and delivering American Portland cement for use at Lock No. 1, Kentucky River, Kentucky.

Name of contractor: Alma Cement Company.
Date of approval: October 6, 1904.
Date of beginning and date of expiration: Cement to be delivered only upon

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orders of the engineer. If work of construction proceeds as is now expected, the entire amount of cement will be needed during the working season of 1904.

Item.	Contract price (unit rate per barrel in bags).
ALMA PORTLAND CEMENT.	
900 barrels in bags delivered f. o. b. Worthville, Ky	a $1.71

a Rebate of 10 cents allowed for each empty bag returned to point of delivery.

Contract for furnishing and delivering, f. o. b. cars, Valleyview, Ky., yellow-pine timber for repair of Lock No. 9, Kentucky River, Kentucky.

Name of contractor: Meeds-Gray Lumber Company.
Date of approval: May 13, 1905.
Date of beginning: May 15, 1905.
Date of expiration: August 1, 1905.

Item.	Contract price (unit rate).
193,417 feet B. M. yellow-pine timber ..... M. ft. B. M.	$25.75
192,333 feet B. M. yellow-pine timber ..... do	24.75
15,267 feet B. M. yellow-pine timber ..... do	23.50

Contract (emergency) for rent of strip of land at Spears, Ky., between a side track of the Louisville and Atlantic Railroad for the purpose of unloading material during the time repairs are being made to Lock No. 9, Kentucky River, Kentucky.

Name of contractor: O. T. Soper.
Date of approval: (Emergency).
Date of beginning and date of expiration: To begin immediately after execution of contract and to terminate when repairs are completed and side track removed.

Item.	Contract price.
Rent of strip of land at Spears, Ky	$100.00

Contract (emergency) for furnishing and delivering f. o. b. cars, Valleyview, Ky., driftbolts for repair of Lock No. 9, Kentucky River, Kentucky.

Name of contractor: J. G. Frelinger.
Date of approval: (Emergency).
Date of beginning and date of expiration: Delivery to be completed on or before June 30, 1905.

Item.	Contract price (unit rate).
1,100 driftbolts ¾ by ¾ inch by 14 inches; approximate weight 1,706 pounds, per pound	$0.020
3,920 driftbolts ¾ by ¾ inch by 24 inches; approximate weight 15,013 pounds, per pound	.020

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Contract (emergency) for furnishing and delivering f. o. b. cars, Valleyview, Ky., oak lumber for repair to Lock No. 9, Kentucky River, Kentucky.

Name of contractor: The C. W. Sowles Lumber Company.
Date of approval: (Emergency).
Date of beginning and date of expiration: Lot No. 1.—Delivery to be completed on or before July 10, 1905. Lot No. 2.—Delivery to be completed on or before September 1, 1905.

Item.	Contract price (unit rate).
Lot No. 1:	
12,000 feet B. M. oak lumber ..... per M. feet B. M..	$26.50
Lot No. 2:	
13,750 feet B. M. oak lumber ..... do....	31.00

Contract (emergency) for furnishing and delivering f. o. b. cars, Valleyview, Ky., yellow pine timber for repairs to Lock No. 9, Kentucky River, Kentucky.

Name of contractor: Meeds-Gray Lumber Company.
Date of approval: (Emergency).
Date of beginning and date of expiration: Delivery to be completed on or before July 25, 1905.

Item.	Contract price (unit rate).
28,480 feet B. M. yellow pine timber ..... per M feet B. M..	$26.00

Contract (emergency) for furnishing and delivering, f. o. b. cars Valleyview, Ky., American Portland cement for use at Lock No. 9, Kentucky River, Kentucky.

Name of contractor: Virginia Portland Cement Company.
Date of approval: (Emergency).
Date of beginning and date of expiration: Cement to be delivered only upon orders of engineer. It is expected the entire amount will be needed during the season of 1905.

Item.	Contract price (unit rate per barrel in bags.)
"OLD DOMINION" PORTLAND CEMENT.	
8,000 barrels, in bags, delivered f. o. b. Valleyview, Ky	[a] $2.01

[a] Rebate of 10 cents allowed for each empty bag returned to point of delivery.

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COMMERCIAL STATISTICS.

Statement of traffic passing the locks on Kentucky River during the calendar years 1901, 1902, 1903, and 1904.

Lock—	Passenger boats.				Towboats.				Government boats.			
	1901.	1902.	1903.	1904.	1901.	1902.	1903.	1904.	1901.	1902.	1903.	1904.
No. 1	695	391	567	407	217	149	189	294	13	26	8	6
No. 2	588	317	473	386	209	131	150	252	36	42	33	7
No. 3	244	251	289	169	194	148	131	219	81	118	90	16
No. 4	262	306	318	199	210	172	160	269	66	173	171	17
No. 5	199	208	215	153	78	53	66	219	50	51	60	4
No. 6	183	186	228	128	82	28	50	200	55	56	44	8
No. 7	181	208	294	120	41	34	49	208	41	46	35	3
No. 8	76	78	171	98	22	15	22	128	31	32	24	3
No. 9	.....	.....	.....	44	.....	.....	1	93	.....	.....	.....	1
Total	2,428	1,985	2,505	1,704	1,008	730	768	1,877	373	544	465	60

Lock—	Coal barges.				Other barges.				Small craft.			
	1901.	1902.	1903.	1904.	1901.	1902.	1903.	1904.	1901.	1902.	1903.	1904.
No. 1	208	124	170	116	131	239	325	288	84	52	56	4
No. 2	186	92	152	86	137	115	213	238	47	35	71	4
No. 3	188	86	149	92	257	238	256	309	90	62	81	5
No. 4	186	88	152	92	204	272	330	307	142	154	142	9
No. 5	60	30	42	28	122	166	287	177	80	95	71	4
No. 6	22	17	21	28	107	159	220	191	206	175	230	12
No. 7	27	17	19	10	96	160	270	199	149	121	101	12
No. 8	7	5	12	.....	49	61	190	153	74	62	85	11
No. 9	.....	.....	.....	.....	.....	.....	2	245	.....	.....	5	14
Total	884	459	717	442	1,103	1,410	2,102	2,492	872	756	902	76

Lock—	Rafts.				Total.				Increase (+) or decrease (−) over 1903.
	1901.	1902.	1903.	1904.	1901.	1902.	1903.	1904.	
No. 1	537	213	656	818	1,885	1,194	1,921	2,033	+ 11
No. 2	508	208	644	822	1,711	940	1,736	1,898	+ 16
No. 3	501	217	664	792	1,555	1,120	1,610	2,117	+ 50
No. 4	506	236	686	844	1,576	1,401	1,968	1,998	+ 3
No. 5	1,648	1,084	1,514	1,272	2,237	1,682	2,255	1,941	− 31
No. 6	1,644	940	1,596	1,288	2,249	1,561	2,389	2,009	− 38
No. 7	1,588	1,109	1,942	1,359	2,123	1,690	2,110	2,053	− 5
No. 8	1,888	1,501	1,832	1,728	2,142	1,754	2,336	2,250	− 8
No. 9	.....	.....	.....	1,857	.....	.....	8	2,406	+2,39
Total	8,815	5,508	8,874	10,780	15,478	11,342	16,333	18,705	+2,37

Lock—	Total tonnage.				Increase (+) or decrease (−) over 1903.	Lockages.				Increase (+) or decrease (−) over 1903.
	1901.	1902.	1903.	1904.		1901.	1902.	1903.	1904.	
No. 1	188,773	138,370	204,953	186,940	− 18,013	1,221	714	1,201	1,356	+ 15
No. 2	176,283	111,190	181,203	166,776	− 14,427	1,304	719	1,161	1,391	+ 23
No. 3	191,051	114,862	176,507	230,278	+ 53,771	1,200	867	1,183	1,554	+ 37
No. 4	161,719	131,045	189,901	174,560	− 15,341	1,173	1,101	1,429	1,415	− 1
No. 5	186,461	137,509	188,071	161,517	− 26,554	1,808	1,081	1,398	1,169	− 22
No. 6	170,499	124,870	178,264	153,250	− 25,014	1,068	843	1,215	1,092	− 12
No. 7	168,750	131,413	162,880	163,932	+ 1,052	906	838	1,029	992	− 3
No. 8	186,109	132,068	178,212	174,094	− 4,118	879	692	924	1,001	7
No. 9	.....	.....	342	169,807	+169,465	.....	.....	3	1,051	+1,02
Total	1,404,645	1,021,297	1,460,333	1,581,154	+120,821	9,114	6,850	9,543	11,001	+1,45

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Statement of commerce, in tons, passing the locks on Kentucky River, Kentucky, during the calendar years 1901, 1902, 1903, and 1904.

Articles.	Lock No. 1.				Lock No. 2.			
	1901.	1902.	1903.	1904.	1901.	1902.	1903.	1904.
Coal	55,742	34,554	47,993	32,441	51,656	27,525	43,450	25,556
Grain	6,122	2,787	3,985	4,098	6,498	2,323	3,457	3,650
Salt	1,074	540	504	464	824	415	341	230
Oil	543	274	358	308	378	199	204	210
Whisky	1,128	1,128	1,357	1,348	1,295	1,200	1,349	1,404
Flour	1,264	1,390	2,264	1,943	542	994	1,584	1,317
Sugar	287	210	315	202	122	157	151	183
Molasses	123	80	55	40	62	69	35	17
Cement	355	521	292	587	172	333	193	355
Tobacco	4,576	3,305	2,902	2,339	3,267	1,923	1,591	1,575
Hay	221	867	1,014	766	122	608	212	626
Live stock	952	650	1,139	784	490	357	687	409
Lumber and timber	39,841	29,212	52,443	74,552	37,614	17,046	52,905	73,967
Shingles	201	111	184	81	62	85	65	29
Manufactured iron	144	115	206	271	138	153	171	215
Produce	107	118	106	104	66	100	100	55
General and miscellaneous	9,505	8,646	10,663	5,871	5,219	4,125	7,179	4,189
Total	122,185	84,498	125,722	126,284	108,517	57,612	118,674	114,007
Number of passengers	7,110	5,075	7,822	7,592	3,789	4,265	5,865	4,998

Articles.	Lock No. 3.				Lock No. 4.			
	1901.	1902.	1903.	1904.	1901.	1902.	1903.	1904.
Coal	47,028	27,243	40,850	23,732	42,078	26,467	42,358	23,350
Grain	6,242	2,704	3,255	3,645	6,432	2,325	3,293	3,361
Salt	1,221	286	174	119	634	177	139	81
Oil	153	104	87	125	154	71	84	76
Whisky	1,198	1,114	1,351	1,333	1,106	1,572	1,308	1,173
Flour	360	696	1,040	887	321	503	947	671
Sugar	73	86	70	85	44	33	57	71
Molasses	40	33	19	13	39	21	12	7
Cement	90	428	367	201	100	539	269	188
Tobacco	1,209	1,145	614	569	396	266	198	229
Hay	123	524	162	443	118	505	141	489
Live stock	194	179	400	290	79	71	221	110
Lumber and timber	35,733	19,000	51,577	67,124	36,925	18,528	51,368	70,229
Shingles	67	46	35	10	61	21	31	15
Manufactured iron	33	197	135	250	16	102	132	239
Produce	18	102	40	50	18	52	31	22
General and miscellaneous	9,981	3,911	4,416	2,404	3,610	5,368	4,022	1,811
Total	103,761	57,798	104,592	101,280	92,131	56,671	104,596	102,122
Number of passengers	1,681	3,732	4,778	3,708	1,973	3,884	4,787	3,951

Articles.	Lock No. 5.				Lock No. 6.			
	1901.	1902.	1903.	1904.	1901.	1902.	1903.	1904.
Coal	15,392	9,605	10,001	7,119	6,390	5,027	4,186	4,439
Grain	4,636	2,254	2,715	3,212	3,764	2,349	2,728	3,163
Salt	231	133	79	46	168	68	81	37
Oil	58	22	18	36	64	9	18	26
Whisky	1,194	1,217	1,290	1,200	995	1,086	1,256	598
Flour	112	111	167	181	85	124	162	97
Sugar	15	11	16	26	11	10	15	17
Molasses	23	4	8	2	17	3	3	-------
Cement	60	125	43	124	35	80	38	92
Tobacco	282	70	158	166	170	32	52	25
Hay	21	449	147	291	10	445	122	188
Live stock	46	30	183	102	56	5	176	47
Lumber and timber	123,757	80,346	105,051	114,105	124,795	77,665	114,680	112,973
Shingles	21	13	-------	5	19	1	2	4
Manufactured iron	8	33	113	17	11	6	112	27
Produce	4	50	10	10	2	10	10	7
General and miscellaneous	1,244	1,351	6,701	976	823	1,053	3,240	690
Total	147,134	95,833	126,695	127,618	137,345	87,973	126,881	122,490
Number of passengers	3,139	2,802	4,016	3,495	4,017	3,640	4,814	3,077

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Statement of commerce, in tons, passing the locks on Kentucky River, Kentucky, during the calendar years 1901, 1902, 1903, and 1904—Continued.

Articles.	Lock No. 7.				Lock No. 8.			
	1901.	1902.	1903.	1904.	1901.	1902.	1903.	1904.
Coal	5,017	5,027	3,885	3,700	1,453	1,061	1,570	276
Grain	4,433	1,957	2,467	3,011	16	185	92	199
Salt	171	71	56	26	102	70	30	12
Oil	49	5	69	19	15	5	4	10
Whisky	930	743	1,197	602	41		3	
Flour	73	55	103	57	39	14	56	2
Sugar	6	3	8	11	3		1	4
Molasses	7				2			
Cement	18	82	22	69	12		95	69
Tobacco	88	20	11	10	76		10	
Hay	5	442	123	159	1			20
Live stock	64	19	139	39	25	8	93	24
Lumber and timber	123,822	83,369	101,149	123,218	140,902	111,795	129,798	148,307
Shingles	9				2			
Manufactured iron	19	2	107	12	15	4	101	11
Produce	6				12			
General and miscellaneous	756	1,296	1,684	718	4,346	570	353	429
Total	135,473	93,101	111,023	131,651	147,062	113,682	132,296	149,389
Number of passengers	3,663	2,992	4,462	2,996	1,854	1,475	3,447	2,779

Articles.	Lock No. 9.	
	1903.	1904.
Coal		151
Oil		8
Live stock		2
Lumber and timber	40	148,737
Manufactured iron		1
General and miscellaneous	2	331
Total	42	149,230
Number of passengers	14	1,448

List of boats plying the Kentucky River, Kentucky, during calendar year ending December 31, 1904.

Name of boat.	Character.	Length.	Breadth.	Depth.	Tonnage.
		Feet.	*Feet.*	*Feet.*	
Gen'l O. M. Poe	United States towboat	145.60	34.0	4.6	150.00
Pearl	United States launch	40.00	8.0	4.0	5.00
Falls City	Packet	151.67	36.0	4.4	235.00
Golden Gate	do	131.40	30.0	4.0	142.00
Hattie Brown	do	120.00	20.0	3.0	58.11
White Dove	do	65.00	14.0	3.0	35.00
Oneita	do	55.00	12.0	3.5	11.00
Mountain State	Towboat	143.70	28.0	3.5	142.00
John Mackey	do	140.00	22.5	4.0	100.00
Bellevue	do	135.00	27.0	3.5	89.00
W. M. Duffy	do	126.00	22.0	3.5	78.67
Nellie Willett	do	122.50	28.0	4.0	98.00
Mildred	do	116.00	24.0	3.0	92.00
E. T. Slider	do	110.00	24.0	3.5	92.00
Raymond	do	102.60	22.0	3.0	67.02
Innovator	do	100.00	20.0	3.0	62.00
Charley Curlin	do	92.00	18.5	3.5	92.00
Vivian	do	90.00	21.0	3.8	75.00
Mabel	do	80.00	17.0	3.5	49.00
Gladys	do	76.00	11.0	2.6	60.00
Minnie	do	73.00	16.0	2.8	68.00
Blue Wing	do	62.00	11.0	1.5	40.00
Louise	do	60.40	9.5	2.0	9.00
Charley Boy No. 2	do	58.00	10.5	2.6	44.96
Fannie	do	55.00	11.0	2.4	10.00
Three Friends	do	55.00	8.0	2.0	5.00
Dove	do	47.00	8.0	1.5	18.00
Lillie	do	26.00	6.0	2.0	3.00
John W. Thomas	do	60.00	12.0	3.4	13.00
Champion	Sawmill boat	90.00	26.0	4.5	69.00

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List of boats plying the Kentucky River, Kentucky, during calendar year ending December 31, 1904—Continued.

Name of boat.	Character.	Length.	Breadth.	Depth.	Tonnage.
		Feet.	*Feet.*	*Feet.*	
Dixie	Pleasure boat	86.00	16.0	3.0	35.00
Ramona	do	71.00	12.0	2.5	12.00
We Three	do	70.00	15.0	2.5	14.00
Shamrock	do	56.00	10.0	3.0	9.00
Charter	do	50.00	12.0	2.0	13.00
Hypnotizer	do	47.00	10.0	2.4	12.00
Lorelei	do	47.00	9.0	3.2	4.00
Palmetto	do	45.00	9.0	2.4	7.00
Laura	do	45.00	6.8	3.0	4.00
Margaret E. Ray	do	41.00	9.5	2.5	8.00
Willametta	do	40.00	8.0	3.6	10.00
Jessie	do	40.00	7.0	2.0	7.00
Rescue	do	35.00	8.0	4.0	3.00
Neola	do	35.00	7.0	2.5	4.00
Sweetheart	do	35.00	8.0	4.0	3.00
Mona	do	35.00	7.5	1.1	3.00
Pomona	do	35.00	8.0	4.0	3.00
White Star	do	33.00	6.0	4.5	4.00
Merry Houston	do	32.00	8.0	4.6	4.00
Sarah	do	32.00	8.5	5.0	3.00
Edna Roberts	do	32.00	6.0	4.0	2.00
Helen	do	32.00	7.0	2.5	3.00
Adelaide	do	31.60	7.0	3.5	3.00
Catherine L	do	30.00	7.0	3.5	5.00
Hazel D	do	30.00	6.0	4.0	2.00
Ida	do	30.00	8.0	3.5	2.00
Son-of-a-Gun	do	30.00	6.0	3.0	2.00
Drennon Springs	do	30.00	7.0	5.0	2.00
Nayda	do	28.00	6.0	4.0	2.00
Juanitta	do	25.00	6.0	3.0	2.00
Kathryn	do	25.00	6.0	5.0	2.00
Laura L	do	25.00	6.0	4.0	2.00
Old Crow	do	25.00	5.6	4.4	2.00
Kainlan	do	25.00	5.3	3.0	2.00
Clara L	do	25.00	6.0	3.5	2.00
Raymond	do	21.00	4.8	2.5	1.50
Minnie	do	20.00	4.0	3.0	1.50
Caroline	do	20.00	6.0	3.0	2.00
Watoma	do	20.00	5.0	4.4	2.00
Hudson	do	18.00	5.0	2.0	1.00
Avon	do	16.00	5.0	2.0	2.00
Bernadotte	do	16.00	3.5	3.0	1.00
Lucy	do				
Mary H	do				
Talawana	do				
Cherokee	do				
Ebbie	do				
Lena	do				
O. K	do				
Outing	do				
Hiawatha	do				
Ione	do				

NOTE.—Where no dimensions are given the boats are small gasoline launches.

List of leases in force during the fiscal year ending June 30, 1905, Kentucky River, Kentucky.

Location: Lock No. 4.
Lessee: Kentucky River Mills.
Date: July 10, 1878.
Expires: July 10, 1977.
Annual rental: $180.

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APPENDIX H H.

IMPROVEMENT OF FALLS OF THE OHIO RIVER; OF WHITE RIVER INDIANA; OF WABASH RIVER, INDIANA AND ILLINOIS, AND OF CERTAIN RIVERS IN KENTUCKY.

REPORT OF CAPT. HARRY BURGESS, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1905, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Falls of Ohio River at Louisville, Kentucky.
2. Operating and care of Louisville and Portland Canal, Kentucky.
3. Wabash River, Indiana and Illinois.
4. Operating and care of lock and dam at Grand Rapids, Wabash River.
5. White River, Indiana.
6. Green River, above the mouth of Big Barren River, Kentucky.
7. Operating and care of locks and dams on Green and Barren rivers, Kentucky.
8. Rough River, Kentucky.
9. Operating and care of lock and dam on Rough River, Kentucky.

UNITED STATES ENGINEER OFFICE,
Louisville, Ky., July 18, 1905.

GENERAL: I have the honor to transmit herewith annual reports of the works under my charge at the close of the fiscal year ending June 30, 1905.

Very respectfully, your obedient servant,

H. BURGESS,
Captain, Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

H H 1.

IMPROVEMENT OF FALLS OF OHIO RIVER AT LOUISVILLE, KENTUCKY.

A condensed description of the original condition, outline of projects will be found on page 493 of this report; references to more detailed information may be found on page 488, Annual Report of the Chief of Engineers for 1904.

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The principal operations during the year consisted of the repairs to Wave Rock and Willow Point dikes, Indiana Chute, and the continuation of rock excavation at the head of the Louisville and Portland Canal.

The dikes at Wave Rock and Willow Point are constructed of irregular-shaped rock of rather small size obtained from the excavation work at those localities and placed by hand without mortar of any description; the curved surface is carefully paved with the same kind of material.

During the winter of 1904–5 the movement of heavy ice occurred throughout an unusually long period and with a stage of water in the river barely sufficient to submerge the dikes. The result of this heavy and continued ice movement against the dikes was extensive damage to the one at Wave Rock and slight displacement of the paving on the one at Willow Point, the construction facilitating the displacement of the loose rock after the paving had been removed. An allotment of $21,650, from the appropriation for "Emergencies in River and Harbor Works," was made August 17, 1904, to cover the expense of necessary repairs to the dikes, and the work commenced September 7 and completed December 7, 1904, at a cost of $14,545.06. The large saving from the estimated cost was due to the finding of a bed of good sand near by the work and the cement being obtained at a much less price than was anticipated by the estimate. The unusually favorable working season was also a factor in reducing the cost.

The unexpended balance of the allotment, $7,104.94, was covered back into the Treasury of the United States, in accordance with instructions from the Chief of Engineers, dated March 10, 1905.

In making the repairs all rock used was embedded in natural cement mortar, the details of which work are set forth in the report of Mr. Granville W. Shaw, assistant engineer, submitted herewith.

During the past winter these two dikes were further damaged by heavy ice, but not to such a great extent as in the previous year. The river and harbor act of March 3, 1905, provided sufficient funds for the repairs, and the work will be done as soon as the water reaches a stage favorable for the operations.

The work of excavating rock from the enlargement at the head of the Louisville and Portland Canal, east of the old cross dam, was continued by the canal dredges when they could be spared from their regular work of removing deposit from the canal. As the amount available for the work was so small, no continuous or extensive operations could be undertaken, and work done was confined to removing a part of the rock disrupted during the previous year. The total quantity so removed is 14,021 cubic yards, scow measurement, or 7,010 cubic yards, measured in place.

The estimates of cost given in the projects for this rock excavation are based upon carrying such excavation to elevation 34, canal references, and make no allowance for rock removal below that plane, but on account of the formation of the rock presenting a seam near the prescribed grade plane it has been found impracticable to make the excavation economically without breaking to the seam 1 or 2 feet below grade, thus necessitating the removal of the additional rock. A recent careful survey shows the bottom excavation already done to be from 1 to 2 feet below the proposed grade, thus making

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a 50 per cent increase over the estimate. In consequence the item of rock excavation remaining to be done will cost more than is provided for in the approved estimate for that item. The details of the year's work are given in the report of Mr. J. H. Casey, assistant engineer, submitted herewith.

The river and harbor act approved March 3, 1905, contained items applicable to this work, as follows:

Improving the Falls of the Ohio River at Louisville, Kentucky: For maintenance and alteration of the existing dam, eighty thousand dollars; and

Improving Ohio River: General improvement, three hundred thousand dollars: *Provided*, That from said amount the Secretary of War may, in his discretion, expend from the amount herein appropriated a sum sufficient for the following, or either of them, namely, to remove the rocks in the channel of said river or canal near to the Falls at Louisville, Kentucky. * * *

A project for the expenditure of the first-mentioned item was submitted March 31, 1905, and approved April 1, 1905. It provides for the maintenance of existing structures; the construction of a movable dam of the Boulé type to replace the old wooden, fixed dam between Middle and Indiana chutes. Subsequently approved plans for this dam are for a trestle of such design that the wickets may be given a height of 9 feet, upper canal gauge, otherwise the features and location of the new movable dam are in accordance with the plans and recommendations of the Board of Engineer officers, approved December 30, 1901. Under the expenditure project it was proposed to purchase the steel work, etc., by contract and construct the foundations, piers, etc., by hired labor, etc.; pursuant to this, proposals for the steel trestles, trestle boxes, connecting frames and other metal work have been received, and award made to the Brackett Bridge Company, of Cincinnati, Ohio, for the work at prices quoted below, but the contract had not been signed at the end of the fiscal year:

[Cents per pound.]

240 steel trestles with hinge blocks and chain connections attached	4.16
240 wrought-iron deck-connecting frames	3.92
240 upstream cast-iron trestle boxes	4.1
240 downstream cast-iron trestle boxes	4.1
960 wrought-iron hold-down bolts and nuts	3.80
960 washers for 1½-inch bolts	2
240 1¾-inch wrought-iron upstream trestle-box pins	3
240 1¾-inch wrought-iron downstream trestle-box pins and nuts	3
480 ⅞-inch wrought-iron deck-frame bolts and nuts	3
47 angle bars, 20 feet by 6 inches by ½ inch, 19.6 pounds per foot	2.35
2 9-inch I beams, 10 feet by 6 inches each, 21 pounds per foot	2.15

Other preparations, such as the purchase of material for the cofferdam, sills, wickets, and cement for the piers, etc., have been made with a view to beginning the construction as soon as the stage of water permits.

A project for the amount to be allotted for removal of the rock at the head of the Louisville and Portland Canal, as provided for in the second item of appropriation mentioned above, was submitted under date of March 22, 1905, but up to the close of the fiscal year no allotment for the work had been made.

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Money statement.

July 1, 1904, balance unexpended		$7,916.75
Amount appropriated by river and harbor act approved March 3, 1905		80,000.00
Net amount allotted from appropriation for maintenance of river and harbor improvements, act of April 28, 1904		[a]14,545.06
		102,461.81
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$7,965.08	
For maintenance of improvement	14,545.06	
		22,510.14
July 1, 1905, balance unexpended		79,951.67
July 1, 1905, outstanding liabilities		1,532.67
July 1, 1905, balance available		78,419.00
Amount (estimated) required for completion of existing project		477,569.79
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$350,000.00	
For maintenance of improvement	5,000.00	
		355,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

NOTE.—In connection with the "Amount (estimated) required for completion of existing project," it seems desirable to state that surveys made during the past fiscal year have afforded data for a careful computation of the item for excavation of rock in the enlargement at the head of the canal, and that the balance remaining from the former estimates made several years ago will not be sufficient for completion of existing project. A detailed statement of the amount required for completion of all the work so far projected and approved, but not yet provided for, based upon the late surveys, follows:

18,862 cubic yards earth excavation		$15,337.05
13,247 cubic yards solid rock excavation at head of canal		36,706.51
3,801 cubic yards new south wall		22,804.80
2,366 square yards slope revetment		5,322.83
1,736 cubic yards old wall and guard gate abutment to be removed		1,952.70
20,095 cubic yards disrupted rock to be removed		31,702.45
2,500 cubic yards submerged dam at Whirlpool Point		7,500.00
22,300 cubic yards longitudinal contracting dikes		267,600.00
3,000 cubic yards submerged dams below railroad bridge		60,000.00
3,200 cubic yards rock excavation, Indiana Chute		11,200.00
600 linear feet Boulé dam to be raised		2,500.00
Contingencies		46,921.74
		509,548.08
Additional work recommended by the Board of Engineers for Rivers and Harbors, but not yet adopted by Congress:		
500 feet Boulé dam across Middle Chute	$37,500	
650 feet chanoine wicket dam, including abutments, service bridge, etc	130,000	
600 feet concrete, dam, north of Indiana Chute	15,000	
Contingencies	36,500	
		219,000.00
		728,548.08

[a] The total allotment was $21,650, but of this amount $7,104.94 was covered back into the Treasury.

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APPROPRIATIONS.

Enlargement at head of canal and of basin at lock:		
July 5, 1884	$300,000.00	
August 5, 1886	150,000.00	
August 11, 1888	150,000.00	
September 19, 1890	60,000.00	
July 13, 1892	60,000.00	
August 18, 1894	60,000.00	
		$780,000.00
Appropriations for improving Falls of Ohio River and Indiana Chute, Falls of Ohio River:		
June 3, 1896	$10,000.00	
June 4, 1897	350,000.00	
July 1, 1898	152,250.00	
March 3, 1899	15,000.00	
June 13, 1902	41,000.00	
March 3, 1905	80,000.00	
		648,250.00
Allotments for Indiana Chute from appropriations for improving Ohio River:		
July 14, 1880	$10,000.00	
March 3, 1881	50,000.00	
August 2, 1882	35,000.00	
July 5, 1884	10,000.00	
August 5, 1886	20,000.00	
August 11, 1888	15,000.00	
		140,000.00
Appropriations for work on Indiana Chute:		
September 19, 1890	25,000.00	
July 13, 1892	35,000.00	
August 18, 1894	20,000.00	
		80,000.00
Net allotment from appropriations for maintenance of river and harbor improvements, act of April 28, 1904		14,545.06
Total		1,662,795.06

COMMERCIAL STATISTICS.

Commercial statistics are given in the report for operating and care of the Louisville and Portland Canal.

REPORT OF MR. GRANVILLE W. SHAW, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
ROOM NO. 425, CUSTOM-HOUSE,
Louisville, Ky., June 30, 1905.

CAPTAIN: I have the honor to submit the following report of operations on the Falls of the Ohio River, Indiana Chute, for the fiscal year ending June 30, 1905.

Between August 2 and August 22 the south abutment of the Indiana Chute opening in the dam at the head of the Falls was repaired and the movable dam raised. The cost of the repairs was $157.04, and of raising and lowering the movable dam, storing the wickets, etc., $146.51. The expense was paid from allotment made July 15, 1904, from "Operating and Care of Canals and Other Works of Navigation, Indefinite."

The ice in the river during the winter of 1903–4 carried away about 850 feet of Wave Rock dike, and it was decided to make the repairs with rubble concrete, the quantity required being about 3,800 cubic yards.

Preparation for work was begun on September 6, the tow boat *Wave Rock* was put in commission on the 7th, and on the 8th tools and material were carried

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over the Falls to the site of the work. It was found that the river was too low to permit the safe passage of the towboat over the lower part of the Falls; material was therefore loaded on small barges and floated to the dike. The barges, when empty, were caught below by the towboat and towed around through the canal.

On September 8 a small force was employed in clearing the foundation for the concrete structure, and a temporary dam was built around that portion of the foundation through which the river was flowing. The work of filling this gap with concrete in jute bags was completed September 22. The work of building the concrete superstructure was continued without interruption, and completed November 25. The paved crown of the uninjured portion of the dike was grouted.

On November 15 repairs to the paving of Willow Point dike were begun and the work was completed November 29. Tools, lumber, forms, and appliances were taken to the warehouse near Eighteenth street and the work closed December 7. The river continuing very low, it was impossible to take the derrick boat and office boat over the lower part of the Falls, and they were left at Whirlpool Point in care of watchmen. On the evening of December 27, during a severe storm, the derrick boat was sunk. On December 30 it was raised and found to be uninjured, and the river having risen, both boats were taken to the locks of the Louisville and Portland Canal on December 31.

The following work was performed:

Wave Rock dike:		
Concrete (rubble)	cubic yards	2,526.6
Concrete (in bags)	do	180.4
Stone filling	do	280.1
Excavation	do	192.5
Grouting	square yards	1,563.1
Willow Point dike:		
Paving repaired	do	964.0

The cost was as follows:

Wave Rock dike:		
Labor		$10,299.44
Material		3,248.10
		13,547.54
Willow Point dike:		
Labor		291.53
Total		13,839.07

The heavy ice during the winter of 1904–5 ran at an unusually high stage, and the upper end of Wave Rock dike and the lower end of Willow Point dike were considerably damaged. Freezing weather set in immediately after the completion of the repairs to Wave Rock dike, and it is believed weakened the concrete before it had thoroughly set. About 460 cubic yards of the upper end were displaced. The crest of Willow Point dike was taken off for 300 or 400 feet.

Preparations are being made to begin the repair of both dikes as soon as the river falls to 7.5, upper canal gauge.

Very respectfully, your obedient servant,

GRANVILLE W. SHAW,
Assistant Engineer.

Capt. H. BURGESS,
Corps of Engineers.

REPORT OF MR. J. H. CASEY, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
IMPROVING OHIO RIVER FALLS, NEAR LOUISVILLE, KY.,
Louisville, Ky., July 6, 1905.

CAPTAIN: I have the honor to submit the following report of operations for improving Ohio River Falls, near Louisville, Ky., during the fiscal year ending June 30, 1905:

Owing to the small amount of funds available July 1, 1904, for the season's work, operations were confined to dredging disrupted rock east of the former

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cross dam blasted during the previous year. The canal towboat and dredges worked at such times during the year as they could be spared from canal dredging.

Dredge *Louisville No. 1* worked day and night from July 18 to 20 and 23 to 26, and day work only from October 28 to November 30, between stations 116 and 129, removing 1,465 cubic yards disrupted rock, scow measure. In addition to this, under the canal allotment, 655 cubic yards, scow measure, were removed in December, 1904.

Dredge *Louisville No. 2* worked day work only from August 10 to October 1 and October 10 to November 30, between stations 117 and 129, removing 2,273 cubic yards disrupted rock, scow measure; also, under the canal allotment, 525 cubic yards rock were removed in December, 1904.

Dredge *Wabash* worked day and night from July 18 to 26, August 8 to October 18, October 22 to November 14, and day work only to November 28, removing 8,198 cubic yards disrupted rock, scow measure; also, under canal allotment, removed 905 cubic yards, scow measure, in December, 1904, and April, 1905. The dredge was laid up ten days on account of repairs to machinery, etc.

The quantity of disrupted rock removed is 14,021 cubic yards, scow measurement, or 7,010 cubic yards, place measurement.

All estimates for rock removal under and east of the former cross dam were based on excavation to elevation 34, canal reference, no allowance being made for any necessary excavation below the grade. Owing to the formation of the rock, the seam of which is only from 1 to 2 feet below grade line, it has been found impracticable to keep to the established grade. A careful survey made November, 1904, shows a depth of from 1 to 2 feet below grade, or 51 per cent of excavation in excess of the former estimate.

During April and May, 1905, compressor boats Nos. 7 and 8 were placed on dry dock, where their hulls were repaired and calked.

Disrupted rocks too large for the dredges to handle were drilled by hand and blasted, using the following material:

Seventy-five per cent dynamite	pounds	36½
Caps	number	67
Fuse	linear feet	313
Exploders, 12-foot	number	24

Expended.

For labor:		
Clerk hire, and watching at Fourteenth street	$940.00	
Dredging disrupted rock	5,403.93	
Repairs to boats	427.15	
Coaling boats for dredges	144.72	
Blasting large rock	33.29	
Painting towboat *Wave Rock*	17.20	
		$6,966.29
For material:		
Gasoline	28.50	
Seventy-five per cent dynamite	36.00	
Ice	28.53	
		93.03
Total		7,059.32

Work done for Indiana Chute.

Repaired and calked skiffs and barges, rolled flues, and prepared new wheel timbers for towboat *Wave Rock*, and built three new barges 12 by 40 feet.

On December 30 and 31 a force of carpenters and laborers raised sunken derrick boat at the Big Eddy; January 1 towed boat to canal where it was repaired.

Expended.

For labor:		
Repairs to boats	$61.70	
New barges	251.27	
Raising sunken boat	46.80	
Repairs on *Wave Rock*	27.61	
		$387.38

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Material:		
1 cast-iron casting	$5.81	
1 coil rope	59.28	
6 bales oakum	20.40	
Oars and buckets	8.33	
Iron, spikes, and nails	14.95	
		$108.77
Total		496.15

Under the appropriation of March 3, 1905, for "Improving the Falls of the Ohio River at Louisville, Ky.," we received the lumber and iron to be used in connection with new Boulé dam, between Middle and Indiana chutes, and commenced to prepare the lumber in the shops and build the six skiffs needed for use on this work; the derrick at Fourteenth Street warehouse was repaired by replacing the old stiff-leg anchorage with new one.

Expended.

Labor:		
Building new skiffs	$47.28	
Repairing derrick at Fourteenth street	23.16	
Dressing foundation lumber	3.94	
		$74.38
Material:		
Lumber	856.89	
Iron	778.35	
		1,635.24
Total		1,709.62

Work remaining to be done July 1, 1905.

South side canal:		
Earth excavation	cubic yards	18,861.9
Rock to be drilled, blasted, and removed	do	4,993.1
Old dry wall to be removed	do	434.4
Old abutment to be removed	do	1,301.8
New wall to be built	do	3,800.8
Stone revetment south side canal	square yards	2,367.5
Rock excavation east of cross dam, old section 3, and under and west of former cross dam, based on work previously done and survey of November, 1904:		
Rock to be drilled, blasted, and removed	cubic yards	8,253.5
Disrupted rock to be removed	do	20,995.3

Very respectfully, your obedient servant,

J. H. CASEY, *Assistant Engineer.*

Capt. H. BURGESS, *Corps of Engineers.*

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OPERATING AND CARE OF LOUISVILLE AND PORTLAND CANAL, KENTUCKY.

Description of original condition and references to former reports, documents, etc., will be found on page 491, Annual Report of the Chief of Engineers for 1904.

The project and estimate for the fiscal year ending June 30, 1905, approved July 15, 1904, provided as follows:

It is proposed to operate the canal and locks and to make such repairs as may from time to time become necessary to maintain them in good navigable condition; to repair parts of the cross dam; to operate the dredging outfit as needed in clearing the canal locks of deposit, etc., brought into them by high

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water; to make such repairs to the towboats, dredges, buildings, walls, slopes, pavements, roadways, bridges, fences, and other Government property as are necessary to maintain them in good condition.

The estimate for the fiscal year 1905 is summarized as follows:

Regular force and extra labor	$55,444.00
Repairs	21,555.00
Four dump scows	13,500.00
Repairs to cross dam	1,900.00
Miscellaneous, supplies and contingencies	12,000.00
	104,399.00

The item for repairs included amounts for the following work:

Repairing middle gates; new locks	$3,693.50
New guard gates; old locks	4,325.00
Repairs to towboat *Major Mackenzie*	2,036.50
Miscellaneous repairs	11,500.00
Total	21,555.00

Under the foregoing project and estimate the operations during the fiscal year, in addition to the usual work of passing traffic and ordinary current repairs incident to care and preservation, were as follows:

The dredging plant removed from the canal 118,967 cubic yards mud and rock; from the channel immediately below the locks, 102 cubic yards disrupted rock; from the cofferdam for repairs to lower miter sill, 125 cubic yards mud and rock; from the enlargement at the head of the canal, 2,110 cubic yards disrupted rock, and from the basin used by the Byrne & Speed Coal Company, 3,815 cubic yards mud. The expense of this latter work was borne by the company mentioned.

A part of the dredging plant was lent for work under charge of the Cincinnati, Ohio, district, at Grassy flats and Falling Run, Ohio River, and the expense while so engaged paid from funds for that river. The work done is summarized as follows:

Mud and sand dredged at Grassy flats	cubic yards	15,860
Mud dredged and cast aside at Falling Run	do	2,500

The principal items of repair work included repairs to the sill and sill masonry at the lower gates of the new locks; new timbers under engines and iron cylinder beams and renewal of certain portions of the hull, etc., of the towboat *Major Mackenzie;* the preparation of timber and iron work for renewing the upper parts of the middle gates, new locks; the construction of new guard gates for the old locks; repairs to about 6,400 square feet of the Portland cement concrete surface of the fixed dam between the Boulé dam at the head of the north canal wall and south abutment of the Boulé dam in the Middle Chute; repairs to the abutment of movable dam in Indiana Chute.

The details of the year's operations are set forth in the report of Mr. J. H. Casey, assistant engineer, submitted herewith.

Following are the statements of expenditures, collections, etc., for the year, together with statements of traffic and commerce passing Louisville, Ky.

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Summary of expenditures on account of operating and care of Louisville and Portland Canal, fiscal year 1905, showing general items and amount expended under each heading:

Item.	Amount.
Services	$61,587.59
Supplies	4,839.31
Materials	24,627.10
Miscellaneous	758.52
Total	91,762.52

Collections.

1904.		
July 12.	I. H. Willett, for use of dry dock	$15.00
Aug. 26.	W. F. Nugent & Bros., for use of dry dock	18.33
Sept. 3.	T. J. Golding, for use of dry dock	38.33
Sept. 13.	O'Donnell & Co., for use of dry dock	76.67
Sept. 17.	Speed Elevator Company, for rent of land	125.00
Sept. 20.	E. T. Slider, for use of dry dock	72.09
Oct. 8.	Louisville and Jeffersonville Ferry Company, for use of dry dock	122.92
Nov. 12.	W. F. Nugent & Bros., for use of dry dock	25.00
Nov. 26.	Louisville Boat Club, for use of dry dock	29.17
1905.		
Jan. 4.	Louisville Cement Company, for rent of land	30.00
Jan. 6.	I. H. Willett, for use of dry dock	78.75
Jan. 12.	Union Cement and Lime Company, for rent of land	5.00
Mar. 1.	The Monongahela River Consolidated Coal and Coke Company, for use of dry dock	26.67
Mar. 11.	The Monongahela River Consolidated Coal and Coke Company, for use of dry dock	28.75
Mar. 31.	Speed Elevator Company, for rent of land	125.00
Apr. 28.	The Monongahela River Consolidated Coal and Coke Company, for use of dry dock	15.00
May 26.	Byrne & Speed Coal Company, for use of dredging plant	170.63
	Total	1,002.31

All of the above collections were deposited to the credit of the Treasurer of the United States.

APPROPRIATIONS AND ALLOTMENTS.

Appropriations.

Act of March 3, 1881 ..... $40,562.91

Allotments.

[From act of March 3, 1881.]

Fiscal year 1882	$54,105.66	Fiscal year 1884	$53,189.18
Fiscal year 1883	61,333.14	Fiscal year 1885	4,872.02

[From act of July 5, 1884.]

———, 1884	$67,496.56	July 11, 1895	$112,838.28
August 3, 1885	91,840.00	July 28, 1896	123,715.05
July 28, 1886	82,320.00	July 23, 1897	67,311.47
July 2, 1887	77,805.00	July 15, 1898	62,061.71
July 13, 1888	99,456.79	July 19, 1899	78,422.89
July 20, 1889	93,744.00	July 18, 1900	78,590.05
July 19, 1890	55,548.88	July 17, 1901	108,550.20
July 17, 1891	78,769.38	July 30, 1902	118,732.34
July 20, 1892	102,175.94	July 24, 1903	43,484.66
July 13, 1893	77,158.68	July 15, 1904	92,385.46
September 9, 1893	2,000.00		
July 11, 1894	114,528.08	Total	2,044,498.33
November 27, 1894	1,500.00		

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COMMERCIAL STATISTICS.

Statement of traffic through the Louisville and Portland Canal from July 1, 1904, to June 30, 1905.

Kind of craft.	Number.	Tonnage.
Passenger boats	410	123,040
Towboats	894	103,628
Government boats	464	27,738
Coal barges	1,979	592,020
Other barges	694	144,618
Small craft	283	108
Rafts	3	
Total	4,727	999,152

Total number of lockages during the fiscal year, 1,946.

Statement of traffic through the open-river channel over the Falls of the Ohio River, at Louisville, Ky., from July 1, 1904, to June 30, 1905.

Kind of craft.	Number.	Tonnage.
Passenger boats	88	30,359
Towboats	377	57,166
Government boats	206	3,084
Coal barges	717	132,671
Other barges	87	35,984
Small craft	6	16
Rafts	1	
Total	1,482	259,280

Statement of commerce through the Louisville and Portland Canal from July 1, 1904, to June 30, 1905.

Articles.	Quantity.	Articles.	Quantity.
	Tons.		*Tons.*
Coal	594,168½	Straw	2,601
Corn	551½	Cattle	1,088
Wheat	4,798½	Swine and sheep	1,455½
Salt	10,906	Horses and mules	184½
Oil	519½	Lumber	26,471½
Whisky	944½	Staves	10,877½
Flour	181½	Shingles	36½
Sugar	322	Steel rails	2
Molasses	1,451½	Manufactured iron	27,317
Cement	453½	Produce	3,590½
Tobacco	1,699½	General and miscellaneous	39,565½
Cotton	359½		
Hay	3,068	Total	732,607½

Number of passengers, 10,779.

Through open-river channel.

Articles.	Quantity.	Articles.	Quantity.
	Tons.		*Tons.*
Coal	479,433½	Cattle	252½
Corn	103½	Swine and sheep	324½
Wheat	161½	Horses and mules	42
Salt	162½	Lumber	6,047½
Oil	127	Staves	13
Whisky	138½	Shingles	2½
Flour	37½	Steel rails	1,800
Sugar	119½	Manufactured iron	7,031
Molasses	20	Brick	6½
Cement	639½	Produce	79½
Tobacco	207	General and miscellaneous	11,821½
Cotton	22½		
Hay	667½	Total	509,642½
Straw	408½		

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Comparative statement of traffic and commerce at Louisville, Ky.

TRAFFIC.

Fiscal year.	Via Louisville and Portland Canal.					Via open river.					Aggregate.
	Passenger boats.	Tow boats.	Coal boats and barges.	Miscellaneous.	Total.	Passenger boats.	Tow boats.	Coal boats and barges.	Miscellaneous.	Total.	
	No.	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*
1898	595	883	2,847	265	4,590	175	435	838	67	1,515	6,105
1899	584	859	2,783	354	4,580	230	659	1,432	148	2,469	7,049
1900	681	968	3,276	328	5,273	94	204	356	85	739	6,012
1901	611	949	3,255	213	5,028	175	619	1,610	188	2,592	7,620
1902	627	770	2,387	430	4,214	134	470	971	124	1,699	5,913
1903	503	870	3,054	285	4,712	202	788	1,539	64	2,593	7,305
1904	518	900	3,456	645	5,519	89	481	926	21	1,517	7,036
1905	410	894	2,673	750	4,727	88	377	804	213	1,482	6,209

COMMERCE.

Fiscal year.	Via Louisville and Portland Canal.			Via open river.			Aggregate.
	Coal.	Other freight.	Total.	Coal.	Other freight.	Total.	
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
1898	859,411	289,353	1,148,764	516,728	53,226	569,954	1,718,718
1899	735,479	251,653	987,132	765,768	95,155	860,923	1,848,055
1900	1,008,524	273,274	1,281,798	274,215	18,181	292,396	1,574,194
1901	863,047	264,540	1,127,587	904,239	94,949	999,188	2,126,775
1902	496,278	351,344	847,622	530,555	95,424	625,979	1,473,601
1903	754,306	230,026	984,332	939,856	108,269	1,048,125	2,032,457
1904	1,413,063	144,328	1,557,391	498,808	43,119	541,927	2,099,318
1905	594,169	138,438	732,607	479,434	30,209	509,643	1,242,250

REPORT OF MR. J. H. CASEY, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
LOUISVILLE AND PORTLAND CANAL,
Louisville, Ky., July 5, 1905.

CAPTAIN: I have the honor to submit the following report of operations for operating and care of Louisville and Portland Canal during the fiscal year ending June 30, 1905.

The canal was open to navigation 337 days and closed 28 days—8 days in October on account of repairs to lower miter sill, 20 days in March and May on account of high water. There was no traffic through the canal on account of ice for 23 days in January and February. During these months the canal was used as an ice harbor by the floating plant and by private boats. The highest stage of water occurred 4 p. m. March 14, when the upper gauge read 22 feet and lower gauge 47.2 feet. The lowest stage occurred December 22, the upper gauge reading 2.2 feet and the lower gauge 2.8 feet.

The Boulé dam was raised and lowered as follows: Sections 3 and 4, raised July 16 to 18; sections 2 and 3, January 4, 5, and 20 to 23, and April 9 and 10; section 4, April 17 and 18; sections 3 and 4, May 5; sections 2, 3, and 4, May 27 and 28; sections 4, 3, and 2, June 23, 24, and 26, respectively.

Sections 3 and 4 were lowered July 13; sections 2, 3, and 4, January 2; sections 2 and 3, January 16 and February 7; section 4 and one-half of section 3, April 30; sections 2, 3, and 4, May 12, and commenced to raise section 2 June 30.

The Middle Chute dam, section No. 6, was raised July 29 to August 4 and lowered December 26, 1904.

The automatic gate was lowered 377 hours during the year.

The lock force operated lock gates; mowed grass on grounds and slopes; trimmed hedge along canal bank; painted guard gates and decks of upper gates; assisted in repairing miter sill at lower gates and removing large disrupted rock from channel below locks; moved electric-light poles from top of banks, north

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and south side of canal, to slopes above revetments at locks; removed property from engine houses during high water, and washed mud from walls, revetments, engine houses, etc.

The employees at the shops made necessary repairs to dredges, towboats, barges, scow, etc.; made and fitted up inner parts for ball bearings on launch *Pearl*, for Kentucky River; put 26 new flues in auxiliary boiler and made injector tank for snag boat *Wm. Preston Dixon;* made new dipper for Green River dredge; made new irons for stiff legs on derrick boat; turned lamp-posts for use on Green River; docked Green River dredge and repaired and calked her hull.

TOWBOATS AND DREDGES.

The towboat *Major Mackenzie* was employed in towing dredges, scows, barges, etc., in connection with dredging in canal and removing disrupted rock for Falls of Ohio River work east of cross dam. Was laid up on account of repairs from October 1 to 5, November 1 to December 12, April 13 to May 12, and May 27 and 28; on account of high water, March 27 and 28, and on account of ice, January 24 to February 28.

The towboat *Col. G. L. Gillespie* was employed in towing scows at intervals when the towboat *Major Mackenzie* was laid up. From August 9 to September 28, inclusive, towed scows for dredge *Louisville No. 1*, working at Grassy flats, Ohio River, for Cincinnati district. On May 30 left for Lock No. 1, Green River, Kentucky, in tow with Green River dredge, returning light June 3. Was laid up on account of repairs October 8 and from May 4 to 26, inclusive.

Towboat *Elinor*, of the Rock Island district, towed scows for dredges May 5 to 9, inclusive, and towboat *Nokomis*, of Mississippi River Commission, on May 10, 11, and 12, while the *Major Mackenzie* and *Col. Gillespie* were laid up for repairs.

Dredge *Louisville No. 1* was employed during the year in dredging mud from canal east and west of guard gates; rock east of cross dam, for Falls of Ohio River; mud and sand from Grassy flats and Falling Run, Ohio River, and dredging basin at Fourteenth street, used by Byrne & Speed Coal Company.

	Cubic yards.
Mud dredged from canal east and west of guard gates	46,562
Mud dredged from basin used by Byrne & Speed Coal Company	2,015
Mud and sand dredged and cast aside at Falling Run	2,500
Mud and sand dredged at Grassy flats	15,860
Disrupted rock dredged east of cross dam and charged to Louisville and Portland Canal	655
Total	67,592

Was laid up on account of repairs 26 days; on account of ice, 24 days; on account of high water, 14 days, and raising and lowering movable dams, 3 days. Worked day and night from July 1 to August 8 and from June 1 to 17.

Dredge *Louisville No. 2* worked day work only from July, 1904, to June 18, 1905, when the crew on dredge *No. 1* was transferred to this dredge, working day and night from June 19 to 23 and 26 to 28, dredging mud in canal east and west of guard gates, loose rock in channel below locks, and disrupted rock east of cross dam for Falls of Ohio River.

	Cubic yards.
Loose rock dredged from channel below locks	102
Disrupted rock dredged east of cross dam and charged to Louisville and Portland Canal	525
Mud removed from canal east and west of guard gates	28,235
Total	28,862

Was laid up on account of repairs 20 days; ice, 24 days; high water, 9 days; and crew raising movable dams, etc., 8 days.

Dredge *Wabash* dredged mud in canal east and west of guard gates; disrupted rock east of cross dam for Falls of Ohio River; mud from basin used by Byrne & Speed Coal Company, at Fourteenth street, and removing cofferdam, etc., used in connection with repairs to lower miter sill.

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	Cubic yards.
Mud dredged from canal east and west of guard gates	36,625
Mud dredged from basin by Byrne & Speed Coal Company	1,800
Rock and mud dredged from cofferdam, lower gates	125
Disrupted rock dredged from east of cross dam and charged to Louisville and Portland Canal	905
Disrupted rock cast aside from rock ledge, for Falls of Ohio River	25
Total	39,480

Was laid up on account of repairs, 13 days; ice, 26 days; high water, 18 days, and 6 days on account of raising and lowering movable dams, etc. Worked day and night from July 1 to November 14, and June 1 to 29.

Green River dredge worked in canal between stations 71 and 96 from April 17 to May 12 and May 24 to 27, removing 7,545 cubic yards mud. Was laid up on account of high water, 8 days, and on account of crew raising and lowering Boulé dam, 2 days.

During the time the dredges were laid up the crews were engaged at work about the canal shops, unloading coal from barges into elevator, etc.

The total amount dredged from the basin used by the Byrne & Speed Coal Company was 3,815 cubic yards mud, for which that company paid $170.63 for the services of dredges and towboat, in addition to their paying the crew's wages, furnishing fuel, etc.

RECAPITULATION OF DREDGING.

	Cubic yards.
Mud and rock dredged from canal east and west of guard gates	118,967
Rock dredged from channel below locks	102
Rock scraped and dredged from east of cross dam and charged to Louisville and Portland Canal	2,110
Mud removed from basin used by Byrne & Speed Coal Company	3,815
Mud dredged from Grassy flats, Ohio River	15,800
Mud cast aside at Falling Run, Ohio River	2,500
Rock and mud dredged from cofferdam at lower gates	125
Total dredging	143,479

REPAIRS.

Towboat Major Mackenzie.—Re-covered boilers and main steam pipe with asbestos cement; fitted up two new pillow blocks; repaired roof, wheel, and rudders. From April 17 to 21, inclusive, was on dry dock, where new planking and framework was put on bow of boat, and the old iron sheeting replaced with No. 14 iron on forward part of boat. In May, M. Zier & Co., of New Albany, Ind., furnished and set up new mud drum, to replace the old one condemned by United States local boiler inspector.

Steamer Col. G. L. Gillespie.—On October 8 was placed on dry dock and broken floor timbers replaced; new cylinder timbers were made and put in place and hog chains repaired. On May 4 the wheel shaft broke and parts of the machinery were injured; the wheel was stripped and a new piece welded onto the broken shaft, cam rods straightened, broken pitman straps repaired, new brasses made for pillow blocks, pitmans, and crosshead, the machinery lined and roof repaired.

Dredge Louisville No. 1.—Made new spud, dipper handle, and new shaft for head of crane; completed one new dipper and repaired the old one; fitted up backing drum shaft and turned and drilled pins for endless chain.

Dredge Louisville No. 2.—Made three new spuds, completed work of rebuilding dipper, lagged hoisting drum; turned up frictions on hoisting and backing drum and repaired boom socket, engines, sheave pins, and stiff-leg fastenings.

Dredge Wabash.—On July 2 was placed on dry dock and her hull repaired, calked, and painted; put on new corner irons, new dipper handle trunnion and new timbers under chain sheave leading to swinging engine. Made two new dipper handles, repaired old one and completed new dipper; repaired spud housings, capstan engine, spud, and made one new spud. Expanded flues in boiler and fitted up new shafting and gears for swinging engine.

Green River dredge.—Fitted up knuckle bolts for frictions, roller and brake bands, and made and put on new dipper.

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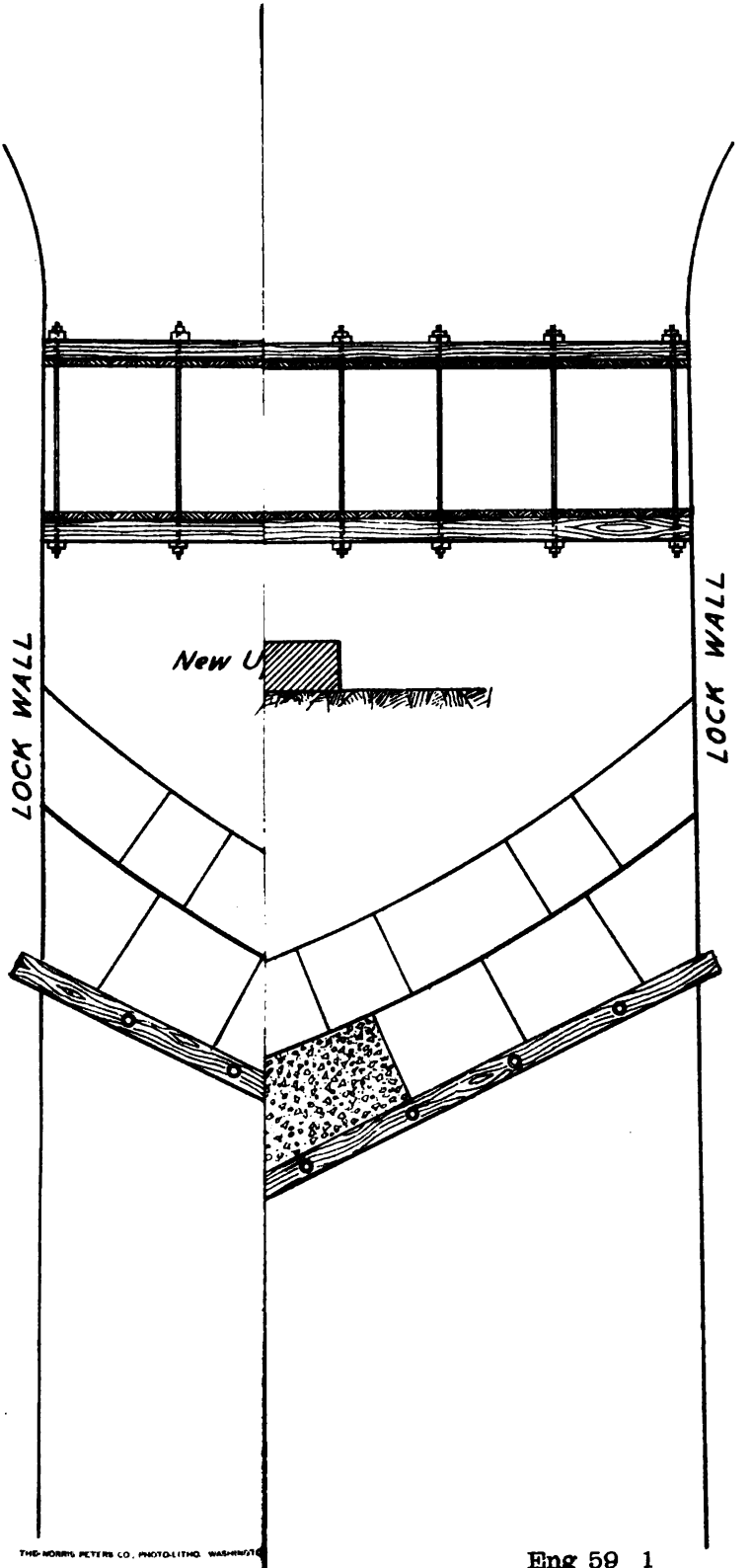

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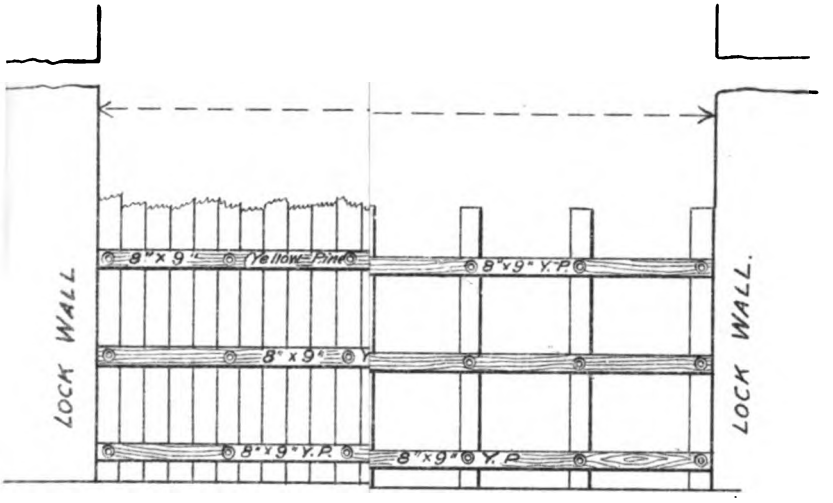

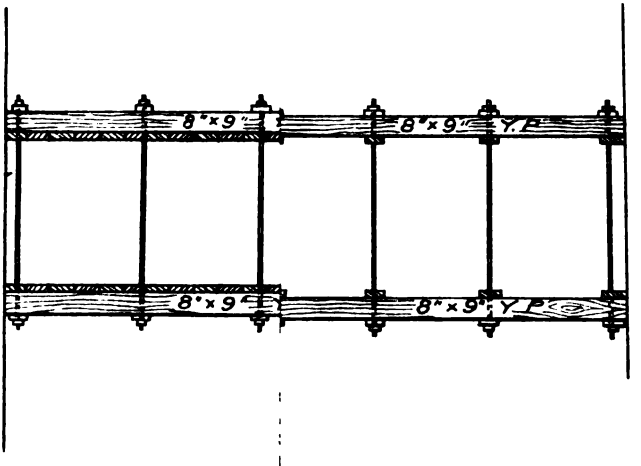

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Canal, shops, etc.—Painted bridge over old canal, woodwork in machine shop, towboat *Wave Rock*, two rooms in Eighteenth street cottage, surrey, spring wagon, roofs on lock engine houses, machine shop, and coal bin.

Re-covered office porch roof with tin; built new crane in blacksmith shop; replaced rotten floor joist under sawmill floor; reconstructed Green River grapple; made steam pipe boxes for locks; repaired gearing and put new set of rollers under Eighteenth Street Bridge; repaired flooring and put in new timber abutment at north end of Twenty-eighth Street Bridge.

Fitted up new chain rollers for locks; put new fenders on middle gates; replaced worn-out shafting in tunnels for lock-gate operating machinery; made new wickets and repaired old ones, and drilled hinge blocks for Boulé dam; made new smokestack to replace old one on machine shop, and repaired gutters on buildings.

Repairs to miter sill, lower lock gate.—Preparatory to making the repairs, a cofferdam was built across the tail bay and the water in the lower chamber drawn off with the aid of one 12-inch centrifugal and one 10-inch piston pump. On examination, the upper log of the sill was found to be badly worn on the up and down stream sides; the lower log was apparently in perfect condition. The sandstone masonry was found to be broken and three stones missing. The upper oak log was replaced by a new yellow pine one and securely fastened with fox bolts. The damaged masonry was replaced with concrete, composed of 1 part Portland cement, 2 parts sand, and 4 parts 1½-inch broken stone; total quantity of concrete placed, 25 cubic yards. Sketch showing sill and cofferdam is submitted herewith.

Repairs to dump scows, barges, and flats were made from time to time as became necessary.

Extra labor.—Planted 60 trees received from board of park commissioners on the grounds about locks; repainted station numbers along canal wall; removed old wires and telephone poles from south canal bank, between Fourteenth and Twenty-sixth streets; whitewashed the inside of lock engine houses and machine shop.

Graded for walkway on south side of canal, beginning at a point opposite lower lock engine house, thence south to Rudd avenue and west to Thirty-third street, and made the walk with cinders; also built two small wooden bridges over ravine. Trimmed hedge and trees and cut grass and weeds from slopes between Fourteenth and Twenty-eight street bridges; cleaned out dry dock tunnel; made new screens for towboat; removed earth and rock from tunnel leading from dry dock to old canal lock; made packing boxes for surveying instruments; equipped 50 bents, section 3, Boulé dam, with triangular top bars, chains, and clevises for maneuvering; watched and cared for floating plant.

REPAIRS TO TOWBOAT.

The allotment for this work was made for removing timbers, etc., under engines and iron cylinder beams on *Major Mackenzie*, they having been in position since she was built in 1896. During September the contractor for furnishing timber completed the delivery of same, and all was dressed in our mill. On October 5 commenced the work of taking down old steam and water pipes and disconnecting engines and machinery, which were removed from the engine room. On October 8 the boat was placed on the dry dock, where the carpenters and calkers replaced worn-out timbers with new ones, rebuilt wheel, repaired rudders, raised cabin, and placed I-beam posts and braces under same.

Expended:	
Labor	$1,754.84
Material	513.62
Total	2,268.46

REPAIRING MIDDLE GATES.

The present middle gates were erected in November, 1892, and the upper half of both leaves are badly decayed. It is proposed to replace eight arms, etc., in each leaf with new ones. The timbers were received from Henry Koehler & Co., Louisville, Ky., and the work of dressing them was done in the planing mill at the canal locks in November and December. All the ironwork was fabricated in the canal blacksmith shop. Commenced to frame posts in January and set up the ways for building one leaf. In April began assembling the timbers of

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one leaf, which is now completed with the exception of the truss rods and decking. For the second leaf, ways were built in June and the work of assembling timbers commenced. On account of the severe cold winter and high water in spring it was impossible to complete the gates this year, but they are now far enough advanced for an early completion during the next fiscal year.

Expended:	
Labor	$872.18
Material	1,248.32
Total	2,120.50

NEW GUARD GATES, OLD LOCKS.

The present gates were built during the fall of 1893, and are so badly decayed that they can not be economically repaired. Timber for new gates was received and dressed in canal mill; all of the ironwork was fabricated in the canal blacksmith shop; the work of framing timbers was commenced in November, and both leaves completed in March, when, during a stage of high water, the gates were floated and towed to the entrance of the old locks. Before the new gates can be erected it will be necessary to take down the old gates, dock them, and remove the heel-post castings and wickets and place them on the new gates. This will be done early next fiscal year.

Expended:	
Labor	$1,046.66
Material	1,474.85
Total	2,521.51

FOUR DUMP SCOWS.

Two of these scows are to replace old ones and two are necessary for work at head of canal. A contract was entered into with the Monongahela River Consolidated Coal and Coke Company for building the four scows, at $3,394 each. They completed the scows in accordance with the plans and specifications January 7, 1905.

Expended:	
Labor, inspection trip, etc	$73.74
Contract price	13,576.00
Total	13,649.74

REPAIRS TO CROSS DAM.

The work to be done under this heading was to repair about 6,400 square feet of the 3-inch outer layer of Portland cement concrete, which had separated from the natural cement concrete, caused by ice and drift during the winter of 1903 and 1904.

On August 14 commenced to move timbers from Fourteenth street warehouse to dam and building roadway to sand pit. One foreman, two concrete finishers, and a force of laborers cut out the broken parts of the concrete dam, broke stone for concrete, delivered sand, placed and put on top surface.

Quantity of work done was as follows:

Top surface Portland cement concrete put in place (1, 2, 3)	cubic yards	92
Quantity of top surface put in place (1 and 3)	square yards	650
Quantity of sand delivered	cubic yards	120
Quantity of stone broken	do	112

A blacksmith and helper repaired the ironwork of the Boulé dam; six of the damaged trestles were removed, repaired, and replaced, and a number of deck platforms repaired and put on. All of the work was completed September 17, 1904.

Expended:	
Labor	$746.19
Material	310.14
Total	1,056.33

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MISCELLANEOUS SUPPLIES AND CONTINGENCIES.

The purchases made under this heading were for necessary supplies for use in shops, on dredges, and towboats, and fuel for use on boats, locks, and in shops.

DRY DOCK.

The dry dock was used during the year by 19 Government boats 133 days and 2 hours, and by 17 private boats 44 days and 20 hours.

The total amount collected from private boats for use of dock was $546.68.

ACCIDENTS IN CANAL.

The steamer *Bellevue*, on entering canal down bound December 15, 1904, in tow with a coal boat partly loaded, reported to be drawing 2.7 feet, grounded the coal boat north of the north line of bouys when opposite station 108. The boat was towed off with the assistance of U. S. towboat *Col. G. L. Gillespie*, and while being towed through the canal sank opposite station 86 in 5½ feet of water, the canal gauge at the time reading 2.7 feet. The master of steamer *Bellevue* stated that the boat was leaking when he took her in tow, and that the boat's navigating north of the north channel line was due to the inexperience of his pilot.

On June 7, 1905, 1.15 a. m., the steamer *W. W. O'Neil*, owned by the Monongahela River Consolidated Coal and Coke Company, while towing her empty tow, sank in head of canal opposite stations 103 and 105, 250 feet from the south shore. The boat was raised and removed from the canal Sunday June 11, at 12.45 p. m.

Very respectfully, your obedient servant,

J. H. CASEY, *Assistant Engineer.*

Capt. H. BURGESS,
Corps of Engineers.

H H 3.

IMPROVEMENT OF WABASH RIVER, INDIANA AND ILLINOIS.

Description of original condition, projects, object and scope of improvement, etc., relating to the two divisions of the river will be found in Annual Reports of the Chief of Engineers for fiscal years as follows: 1886, page 2239; 1898, page 1870; 1902, page 1984.

References to former reports, documents, etc., may be found on page 492, Annual Report of the Chief of Engineers for 1904, in which report, at page 2729, will be found the report upon the survey of the river below Vincennes.

IMPROVEMENT BELOW VINCENNES.

During the past fiscal year the map, in 65 sheets, of the survey of the river below Vincennes was completed, and an index map in 4 sheets was made and traced.

The snagging operations begun in June, 1904, were continued. In July, 1904, the snag boat *Wm. Preston Dixon* and derrick boat *No. 2* worked in the river below Little Chain, removing 321 snags, cutting 26 overhanging trees, and deadening 15 trees.

In September that part of the river between New Harmony and Little Chain was worked over by parties in skiffs and the snags sawed off to low water, the result being 131 snags cut off and 8 root wads removed.

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On June 12, 1905, the derrick boat, with a chartered barge and small towboat, began operations at New Harmony, working toward Mount Carmel, Ill. During the month 56 snags were removed. It is proposed to continue this work until the small balance of funds available is exhausted.

The work so far done has been of considerable benefit, rendering navigation on mid-depth stages of water much more safe.

Money statement

July 1, 1904, balance unexpended	$4,301.20
Refundment from overpayment	.26
	4,301.46
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	2,939.74
July 1, 1905, balance unexpended	1,361.72
July 1, 1905, outstanding liabilities	191.08
July 1, 1905, balance available	1,170.64
Amount (estimated) required for completion of existing project	[a] 40,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905	(a)
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

June 10, 1872	$50,000.00	August 11, 1888	$60,000.00
March 3, 1873	50,000.00	September 19, 1890	60,000.00
June 23, 1874	25,000.00	July 13, 1892	60,000.00
March 3, 1875	40,000.00	August 18, 1894	15,000.00
August 14, 1876	70,000.00	June 3, 1896	15,000.00
June 18, 1878	50,000.00	March 3, 1899	15,000.00
March 3, 1879	20,000.00	June 13, 1902	5,000.00
June 14, 1880	25,000.00		
March 3, 1881	25,000.00	Total	715,000.00
August 2, 1882	40,000.00	Refund from overpayment	.26
July 5, 1884	30,000.00		
August 5, 1886	60,000.00		715,000.26

IMPROVEMENT ABOVE VINCENNES.

No work was in progress on this section of the river during the year, the balance available being too small to permit of any advantageous operations.

Money statement.

July 1, 1904, balance unexpended	$261.58
July 1, 1905, balance unexpended	261.58

[a] This amount is the unexpended balance of former estimate for work at New Harmony Cut-off; appropriations since the estimate was approved have been applied to other purposes. It is believed that the closing of this cut-off, in the absence of a slack-water improvement, would be of great benefit to the navigation interests, as at present the cut-off is an absolute bar to low-water navigation. The estimated cost of closing the cut-off, as given and explained on page 1979, Annual Report of the Chief of Engineers for 1898, is $50,000, all of which should be made available at one time in order that the work may be completed in one working season and the great expense of protecting from damage or destruction an incomplete structure of the kind proposed avoided. An annual appropriation of about $10,000 for snagging, etc., is also very desirable.

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APPROPRIATIONS.

March 3, 1881	$25,000	August 18, 1894	$5,000
August 2, 1882	30,000	June 3, 1896	6,000
July 5, 1884	10,000	March 3, 1899	4,000
August 11, 1888	5,000		
September 19, 1890	5,500	Total	95,500
July 13, 1892	5,000		

COMMERCIAL STATISTICS.

The only commercial statistics available for the year are given in the report for "Operating and Care of the Lock and Dam at Grand Rapids."

H H 4.

OPERATING AND CARE OF LOCK AND DAM AT GRAND RAPIDS, WABASH RIVER.

The project and estimate for the operation and care of this lock and its appurtenant structures during the fiscal year ending June 30, 1905, contained the following items:

Regular force	$1,200
Repairs, etc	3,000
Miscellaneous	600
Total	4,800

The item for repairs also provided for removal of deposit from the lock chamber and approaches thereto, but conditions were such as to prevent that work being done.

Expenditures during the year were for payment of the salary of the lock tender, minor repairs to fences, renewing 56 pieces of sheeting on the lower slope of the dam and replacing 24 cubic yards rock filling in the dam; placing 255 cubic yards earth filling in a washout in the levee above the locks and 30 cubic yards of earth filling in the grounds adjoining the lock, both the levee and the lawn had been badly damaged by the unusually high water which occurred in April, 1904; for painting the lock gates, one coat on lower side, two coats on upper side; and miscellaneous minor repairs to the lock tender's cottage, flag staff, etc.

Summary of expenditures on account of operating and care of lock and dam at Grand Rapids, Wabash River, during the fiscal year 1904, showing general items and amounts expended under each heading.

Item.	Amount.
Services	$1,146.62
Supplies	4.48
Materials	419.76
Miscellaneous	105.08
Total	1,675.94

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ALLOTMENTS.

March 12, 1897	$240.00	July 29, 1902	$1,311.38
July 23, 1897	1,703.25	July 20, 1903	326.89
July 15, 1898	1,451.35	July 15, 1904	2,711.08
July 21, 1899	9,346.16		
July 17, 1900	7,752.52	Total	30,026.95
July 10, 1901	5,184.34		

COMMERCIAL STATISTICS.

Statements of traffic and commerce passing the lock at Grand Rapids, Wabash River, for the fiscal year ending June 30, 1905.

TRAFFIC.

Kind of boat.	Number.	Tonnage.
Passenger	99	455
Tow	121	1,760
Barges	90	7,300
Small craft	1,042	2,183
Rafts	45	
Total	1,397	11,698

Total number of lockages during the year, 806.

COMMERCE.

Articles.	Quantity.
	Tons.
Corn	355
Lumber	296
Staves	60
Timber	6,952
Miscellaneous	362
Total	8,025

Passengers, 483.

Comparative statement of traffic and commerce at lock at Grand Rapids, Wabash River.

Fiscal year.	Traffic.					Commerce.
	Steamboats.	Barges and flats.	Rafts.	Miscellaneous.	Total.	
	Number.	*Number.*	*Number.*	*Number.*	*Number.*	*Tons.*
1897	60	80	27	130	297	3,749
1898	46	76	31	199	352	2,374
1899	45	53	32	118	248	2,417
1900	49	53	36	100	238	6,419
1901	62	68	25	112	267	2,964
1902	48	45	14	171	278	2,448
1903	91	82	10	114	297	2,747
1904	139	53	88	249	479	4,370
1905	220	90	45	1,042	1,397	8,025

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H H 5.

IMPROVEMENT OF WHITE RIVER, INDIANA.

No operations under the existing project for the improvement of this river were in progress during the past fiscal year, the funds under the approved estimate being almost exhausted.

Full report of project, original condition, scope of improvement, etc., will be found in Annual Report of the Chief of Engineers for the fiscal year 1896, page 2244.

References to more extended information may be found on page 497, Annual Report of the Chief of Engineers for 1904.

Money statement.

July 1, 1904, balance unexpended	$703.82
July 1, 1905, balance unexpended	703.82

APPROPRIATIONS.

March 3, 1879	$25,000	August 11, 1888	$5,000
June 4, 1880	20,000	July 13, 1892	5,000
March 3, 1881	20,000	August 18, 1898	5,000
August 2, 1882	20,000	June 3, 1896	2,500
July 5, 1884	10,000		
August 5, 1886	7,500	Total	120,000

H H 6.

IMPROVEMENT OF GREEN RIVER ABOVE THE MOUTH OF BIG BARREN RIVER, KENTUCKY.

The river and harbor act of June 13, 1902, provided funds for the construction of the second lock (No. 6, Green River) proposed in the approved project of August 11, 1891, for the extension of slack-water navigation on this part of the Green River to Mammoth Cave, Ky.

Operations during the year included work under the contract with the Hollerbach & May Contract Company for constructing the lock, dam, and abutment; the construction of the steel gates and operating appliances, under a contract with Lawrence D. Weaning, Cleveland, Ohio; completion of one lock tender's cottage; fencing the Government ground on the lock side of the river, and a period of snagging operations in pool No. 6, from October 28 to November 30, 1904, during which time 4,981 overhanging trees were cut and 1,152 deadened.

The progress to date under the contract for building the lock, dam, and abutment is indicated by the following statement of work which has been estimated for payment to date, viz:

Excavation	cubic yards	34,250
Back fill	do	3,000
Foundation piles	linear feet	9,745
Sheet piles, 9 inches thick	do	4,970

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Foundation and drain timber	feet B. M.	2,790
Miter and coffer sills	number	4
Concrete	cubic yards	8,438
Office, complete	number	1
Broken stone for drain	cubic yards	145
Sewer pipe drain	linear feet	14
Cut-off of foundation piles	do	5,445

During the construction of the foundation, conditions were encountered which made it advisable to modify the original specifications for the work in the manner and to the extent set forth in the abstract of supplemental agreement given below.

The filling culvert valves, valve frames, valve-operating machinery, gratings, lock ladders, miter and coffer sill bolts, corner irons, hollow quoins, tie rods, etc., were furnished and delivered by the Chas. Hegewald Company, of New Albany, Ind., under written proposal and written acceptance, for a uniform price of $4.99 per 100 pounds. A list of the articles furnished follows:

	Pounds.
2 gearing frames, with wheel, 2 pinions, and 2 shafts	2,540
18 sections corner irons	5,370
2 gear wheels	772
3 ladders	1,059
4 bearing plates for gates	661
3 snubbing posts	459
2 small gratings	321
2 large gratings	2,000
2 covered gratings	1,410
2 socket wrenches, with levers	105
108 corner iron bolts	233
34 sill bolts, with 68 washers	769
36 ladder bolts and 86 quoin bolts	284
95 tie-rods	2,381
36 ladder anchors	99
2 valves, with frames and shafts	6,535
20 1-inch bolts, 9 inches long	60
50 half-inch bolts	16
16 sections hollow quoin, each 5 feet long	8,402
4 sections hollow quoin, each 4 feet long	1,555
Total weight	35,031

Total cost, $1,748.04.

The contract with Lawrence D. Weaning included the two upper and two lower gates, the gate spars, capstans for operating, valves in lower gates and valve-operating mechanism, gate anchor rods and pins, cover plates for anchorages, hand railings for gates, hoisting ringbolts for gates, wrenches for adjusting sleeve nuts on anchor bars, pintles for gates, and the necessary bolts, etc., for attaching the wood caps, heel and toe posts. The total weight of the gates, etc., was 84,475 pounds, for which the contract price was the lump sum of $3,975.

The wooden cap pieces, heel and toe posts, were purchased at a cost of $107.81, and put in place by hired labor at an expense of $102.10. The gates are now on board barges ready to be set up in place as soon as the lock is ready to receive them.

The lock tender's cottage, under construction at the end of last fiscal year, was completed by hired labor, the total cost of the building being $3,606.50.

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Money statement.

July 1, 1904, balance unexpended	$177,516.36
Amount appropriated by river and harbor act approved March 3, 1905	5,000.00
	182,516.36
June 30, 1905, amount expended during fiscal year, for works of improvement	81,895.82
July 1, 1905, balance unexpended	100,620.54
July 1, 1905, outstanding liabilities	428.69
July 1, 1905, balance available	100,191.85
July 1, 1905, amount covered by uncompleted contracts	63,613.80

APPROPRIATIONS.

July 13, 1892	$50,000.00	June 13, 1902	$180,000.00
August 18, 1894	25,000.00	March 3, 1905	5,000.00
June 3, 1896	20,000.00		
March 3, 1899	85,673.20	Total	365,673.20

ABSTRACT OF CONTRACT IN FORCE.

Name of contractor: The Hollerbach & May Contract Company.
Date of contract: May 10, 1904.
For building Lock and Dam No. 6, Green River, Kentucky, at prices as follows:

35,615 cubic yards excavation, at 50 cents per cubic yard.
16,900 cubic yards back fill, at 20 cents per cubic yard.
31,000 linear feet foundation piles, at 25 cents per linear foot.
6,600 linear feet sheet piles, 12 inches thick, at 50 cents per linear foot.
17,260 linear feet sheet piles, 9 inches thick, at 40 cents per linear foot.
107,169 feet B. M. foundation and drain timber, at $30 per thousand feet B. M.; 4 miter and coffer sills, at $100 for the lot.
10,360 cubic yards concrete, at $7 per cubic yard.
1 office building, complete, for $1,250.
760 cubic yards broken stone for drain, at $1.70 per cubic yard.
16 linear feet sewer pipe drain, at 50 cents per linear foot.
3,964 cubic yards broken stone filling, under dam and apron, pieces not less than one-half cubic foot, at $1.70 per cubic yard.
3,520 cubic yards backing, above dam, dredged material, at 30 cents per cubic yard.
1,304 cubic yards broken stone filling, below dam, pieces not less than one-half cubic yard, at $1.70 per cubic yard.
552 square yards stone paving, in lock chamber, at $4 per square yard.

The quantities are approximate only.
Contract approved by the Chief of Engineers, United States Army, June 3, 1904.
Work under contract commenced June 14, 1904.
Contract expires January 1, 1906.

Abstract of supplemental agreement in force in connection with the foregoing contract.

Date of supplemental agreement: November 8, 1904.
Provisions:

1. Omit all sheet piling not already driven on the interior of the lock chamber.
2. The United States to accept the piling already driven and the remainder of the sheet piling about the three sides of the lock foundation when driven with, approximately, the same or greater penetration than that already secured.

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3. The United States to pay for the portions of foundation and sheet piles driven below elevation 25, in accordance with original contract requirements, and also pay 10 cents per linear foot for the cut-off portions of foundation piles, when such piles can not be driven to the depth required by the original specifications.

4. To omit the stone paving in the lock chamber; the United States to pay the said The Hollerbach & May Contract Company for the stone purchased by said company for said paving at the rate of $2 per square yard for the stone at the quarry, or $1.104 for the entire 552 square yards, the stone thus becoming the property of the United States. Previous to payment being made the said The Hollerbach & May Contract Company must furnish satisfactory evidence that said company has full right to so dispose of the said stone at the quarry and that it is in no way encumbered.

5. The said The Hollerbach & May Contract Company shall excavate the lock chamber to firm gravel (about grade + 20), for which work the United States shall pay said company at the rate of 50 cents per cubic yard.

6. The said The Hollerbach & May Contract Company shall floor the chamber of the lock with 5 feet of concrete of the same quality and of the same proportions of material as specified for the lock walls; the upper surface of said floor shall be smooth and have a 6-inch slope from the upper to the lower end. For said floor so constructed the United States shall pay the said The Hollerbach & May Contract Company at the rate of $7 per cubic yard.

Supplemental agreement approved by the Chief of Engineers, United States Army, and Acting Secretary of War November 18, 1904, and November 28, 1904, respectively.

COMMERCIAL STATISTICS.

Commercial statistics are given in the report for "Operating and care of locks and dams on Green and Barren rivers, Kentucky."

H H 7.

OPERATING AND CARE OF LOCKS AND DAMS ON GREEN AND BARREN RIVERS, KENTUCKY.

The project and estimate for the fiscal year ending June 30, 1905, approved July 25, 1904, provided as follows:

It is proposed to operate the several locks and to make such repairs to them, the dams, guide cribs, dwellings, storehouses, and other Government property at the several locks, as are necessary to maintain the system in good navigable condition and keep the other Government property in repair in connection with which work the snagging and dredging outfits will be operated to keep the pools, lock chambers, and entrances thereto free from deposits of mud, leaves, snags, and other obstructions brought into them by the varying stages of water. The system now comprises six locks and dams, viz, Nos. 1, 2, 3, 4, and 5, Green River, and No. 1, Barren River, together with the contiguous land and buildings owned by the Government.

The estimate for the fiscal year 1905 is summarized as follows:

Regular force	$41,094.00
Repairs	42,735.71
Miscellaneous, supplies, and contingencies	10,000.00
Total	93,829.71

Under this project and the estimate submitted therewith, the operations during the fiscal year, in addition to the ordinary work of

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passing traffic through the locks and minor current repairs incident to care and preservation, briefly summarized, were as follows:

At Lock No. 1, Green River, the work of placing a concrete top on Dam No. 1, under contract with Hollerbach & May, was resumed in September and completed November 27, 1904. The quantities of work accomplished during the fiscal year 1905, were as follows:

	Cubic yards.
Crib excavation	3,444.12
Earth excavation	843.55
Concrete	3,666.62

The quantities for the entire work of repairing the dam are as follows:

	Cubic yards.
Crib excavation	5,631.12
Earth excavation	1,183.55
Concrete	6,116.62

The total cost of the repairs amounted to $42,709.18.

The dam is 582.25 feet long on its crest between abutments and varies in width from 48.3 to 52.9 feet. The repair of this dam has resulted in material benefit to navigation through the pool above it. The full pool depth now remains constant and the expense of backing the dam each year to prevent excessive leakage is rendered unnecessary.

The only other work in progress at this lock consisted of ordinary current repairs, etc.

At Lock No. 2, Green River, the new cottage and the new office and warehouse were completed, the former at a cost of $3,480.32 and the latter $2,182.47. The repair work included the reconstruction of portions of the upper river crib and lower land crib, 70 linear feet of the apron of dam, 1,040 linear feet new plank fence, 45 feet picket fence, and ordinary current work necessary for maintenance.

At Lock No. 3, Green River, the new office and warehouse was completed, the total cost being $2,195.47. Other work included new fencing around the ground owned by the United States on both sides of the river and the ordinary current work necessary for maintenance.

At Lock No. 4, Green River, a portion 96 feet long of the lower breast of the dam which had been damaged during the past high-water season was repaired with new stringers and ties, the cribbing refilled, and old sheeting replaced; a fence built of material saved from reconstruction of fences on the lock side of the river was placed about the plat of ground at the abutment end of the dam; minor current repairs were made as required to the tools, etc., stored at this lock, and the ordinary work of maintenance done as needed.

At Lock No. 5, Green River, the 500 feet of drainpipe was taken up and relaid so as to give it more fall and prevent its becoming choked with sand and gravel; the bank below the abutment was further protected with riprap over an area of 1,770 square yards; 320 linear feet of fencing at the lower end of the reservation was repaired. Three sink holes which suddenly formed near the upper wing wall were filled with brush and stone, and the ordinary current work necessary for maintenance done as required.

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At Lock No. 1, Barren River, the dam was backed with dredged material, but only temporary reduction of leakage resulted; during the next year it is proposed to take steps to effectively stop the excessive leakage, especially at the abutment. Across the upper end of the lock grounds 910 linear feet of new fencing was built. Other work done was that necessary for current repairs and maintenance.

The floating plant was employed in keeping the pools, entrances to the locks, and the lock chambers free from snags and deposit, and also in assisting with repair work and transporting material for such work. During the winter season necessary repairs were made preparatory for the next season's operations.

The details of the year's operations are set forth in the accompanying report of Mr. W. S. Overstreet, master, to which attention is respectfully invited.

Summary of expenditures on account of "Operating and care of Green and Barren rivers, Kentucky," fiscal year 1905, showing general items and amount expended under each heading.

Item.	Amount.
Services	$68,153.90
Supplies	4,170.52
Materials	31,435.50
Miscellaneous	628.10
Total	74,388.02

Collections.

1904.		
July 14.	Jett & Turner, for water power, Lock No. 2, Green River, Kentucky	$50
July 16.	William Boulton, for water power, Lock No. 1, Barren River, Kentucky	75
1905.		
Jan. 4.	Jett & Turner, for water power, Lock No. 2, Green River, Kentucky	50
Jan. 7.	Craig Brothers, for water power, Lock No. 3, Green River, Kentucky	75
Feb. 3.	R. C. Bryant, for water power, Lock No. 2, Green River, Kentucky	150
	Total	400

All of these collections were deposited to the credit of the Treasurer of the United States.

APPROPRIATIONS AND ALLOTMENTS.

August 11, 1888	$135,000.00	July 23, 1897	$57,459.61
January 4, 1889	167,112.00	July 15, 1898	70,219.75
July 20, 1889	139,110.00	July 22, 1899	65,007.65
July 17, 1890	53,783.47	July 17, 1900	69,349.64
July 16, 1891	77,807.26	July 10, 1901	43,236.82
July 15, 1892	46,264.26	July 30, 1902	105,629.33
July 15, 1893	49,730.88	July 20, 1903	34,720.47
July 13, 1894	25,927.23	July 25, 1904	23,610.25
January 26, 1895	6,000.00		
July 20, 1896	51,080.31	Total	1,298,733.28
September 2, 1896	77,684.35		

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COMMERCIAL STATISTICS.

Statement of traffic passing the locks on Green and Barren rivers from July 1, 1904, to June 30, 1905.

LOCK NO. 1, GREEN RIVER.

Kind of boat.	Number.	Tonnage.
Passenger	331	52,330
Tow	985	59,053
Government	23	3,227
Barges	2,275	750,815
Small craft	253	2,671
Rafts	454	.....
Total	4,321	868,126

Total number of lockages during past fiscal year, 5,168.

LOCK NO. 2, GREEN RIVER.

Kind of boat.	Number.	Tonnage.
Passenger	361	59,443
Tow	676	37,797
Government	21	3,489
Barges	1,297	560,824
Small craft	231	1,776
Rafts	350	.....
Total	2,936	663,329

Total number of lockages during past fiscal year, 3,889.

LOCK NO. 3, GREEN RIVER.

Kind of boat.	Number.	Tonnage.
Passenger	358	57,782
Tow	338	22,508
Government	29	4,698
Barges	910	427,158
Small craft	171	1,428
Rafts	301	.....
Total	2,157	513,564

Total number of lockages during past fiscal year, 2,804.

LOCK NO. 4, GREEN RIVER.

Kind of boat.	Number.	Tonnage.
Passenger	516	73,605
Tow	515	28,779
Government	84	12,389
Barges	917	369,527
Small craft	103	1,675
Rafts	84	.....
Total	2,219	485,975

Total number of lockages during past fiscal year, 2,532.

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Statement of traffic passing the locks on Green and Barren rivers from July 1, 1904, to June 30, 1905—Continued.

LOCK NO. 5, GREEN RIVER.

Kind of boat.	Number.	Tonnage.
Passenger	208	17,598
Tow	465	22,385
Government	63	8,465
Barges	683	231,800
Small craft	272	4,199
Rafts	87	.....
Total	1,723	284,847

Total number of lockages during past fiscal year, 1,656.

LOCK NO. 1, BARREN RIVER.

Kind of boat.	Number.	Tonnage.
Passenger	521	71,637
Tow	302	14,985
Government	138	22,242
Barges	404	105,554
Small craft	159	2,014
Rafts	1	.....
Total	1,525	217,382

Total number of lockages during past fiscal year, 1,452.

Statement of commerce passing the locks on Green and Barren rivers from July 1, 1904, to June 30, 1905.

LOCK NO. 1, GREEN RIVER.

Articles.	Quantity.	Articles.	Quantity.
	Tons.		*Tons.*
Coal	55,149	Hubs	73
Corn	1,281	Straw and hay	27
Wheat	220	Cattle	956
Salt	880	Swine and sheep	1,228
Oil	199	Horses and mules	42
Whisky	88	Lumber	20,097
Flour	946	Timber	216,203
Sugar	765	Staves	1,812
Cord wood	1,542	Shingles	40
Molasses	60	Ties, railroad	136,605
Sorghum	12	Hoop poles	880
Cement	2,461	Manufactured iron	108
Brick	783	Sand	6,597
Tobacco	553	Miscellaneous	15,658
Handles	171		
Hides	4	Total	466,015
Spokes	687		

Number of passengers, 9,072.

LOCK NO. 2, GREEN RIVER.

Coal	1,999	Hides	1
Corn	1,064	Hay and straw	12
Wheat	208	Cattle	394
Salt	648	Swine and sheep	656
Oil	187	Horses and mules	48
Whisky	10	Lumber	12,379
Flour	884	Timber	138,600
Sugar	594	Staves	1,613
Sand	894	Shingles	10
Molasses	45	Ties, railroad	125,609
Sorghum	14	Hoop poles	959
Cement	1,862	Manufactured iron	129
Stone	340	Produce	2
Tobacco	668	Miscellaneous	13,367
Brick	76		
Laths	2	Total	308,274

Number of passengers, 6,646.

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Statement of commerce passing the locks on Green and Barren rivers from July 1, 1904, to June 30, 1905—Continued.

LOCK NO. 3, GREEN RIVER.

Articles.	Quantity.	Articles.	Quantity.
	Tons.		*Tons.*
Coal	6,848	Hay	107
Corn	124	Cattle	296
Wheat	91	Swine and sheep	437
Salt	359	Horses and mules	85
Oil	227	Lumber	2,041
Whisky	8	Timber	108,070
Flour	404	Staves	1,442
Sugar	411	Shingles	1
Molasses	42	Ties, railroad	124,636
Sorghum	5	Hoop poles	771
Cement	2,153	Manufactured iron	73
Cord wood	246	Produce	10
Stone	340	Miscellaneous	7,682
Tobacco	271		
Hides	1	Total	257,181

Number of passengers, 5,904.

LOCK NO. 4, GREEN RIVER.

Coal	19,917	Cattle	57
Corn	70	Swine and sheep	178
Wheat	10	Horses and mules	84
Salt	241	Lumber	2,001
Oil	124	Timber	31,532
Flour	387	Staves	378
Sugar	283	Shingles	22
Molasses	21	Ties, railroad	91,253
Sorghum	4	Hoop poles	596
Cement	2,111	Manufactured iron	1,020
Stone	990	Miscellaneous	5,662
Tobacco	187		
Hides	3	Total	157,208
Hay	98		

Number of passengers, 6,421.

LOCK NO. 5, GREEN RIVER.

Coal	1,872	Cattle	8
Corn	39	Horses and mules	10
Wheat	1	Lumber	899
Salt	51	Timber	34,562
Oil	63	Staves	1,596
Whisky	3	Shingles	9
Flour	112	Ties, railroad	60,994
Sugar	15	Hoop poles	920
Molasses	2	Manufactured iron	20
Sorghum	1	Asphalt	1,651
Cement	2,306	Miscellaneous	1,300
Stone	1,353		
Hay	71	Total	107,848

Number of passengers, 2,115.

LOCK NO. 1, BARREN RIVER.

Coal	14,482	Hay	98
Corn	88	Straw	1
Wheat	14	Cattle	33
Salt	284	Swine and sheep	6
Oil	158	Horses and mules	68
Whisky	14	Lumber	1,526
Flour	405	Timber	4,612
Sugar	264	Staves	39
Cord wood	690	Shingles	23
Molasses	8	Ties, railroad	5,550
Sorghum	2	Hoop poles	807
Cement	8	Manufactured iron	545
Asphalt	1,545	Produce	54
Stone	1,692	Miscellaneous	5,828
Tobacco	198		
Hides	4	Total	38,486

Number of passengers, 6,623.

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Comparative statement of traffic and commerce, Green and Barren rivers Kentucky.

TRAFFIC.

Fiscal year.	Lock No. 1, Green River.					Lock No. 2, Green River.					Lock No. 3, Green River.				
	Steamboats.	Barges and flats.	Rafts.	Miscellaneous.	Total.	Steamboats.	Barges and flats.	Rafts.	Miscellaneous.	Total.	Steamboats.	Barges and flats.	Rafts.	Miscellaneous.	Total.
	No.	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*
1889....	284	129	350	138	901	272	107	300	15	694	.....	.....	200	.....	200
1890....	854	386	1,079	111	2,430	776	286	768	12	1,842	.....	.....	.....	.....	.....
1891....	875	456	1,082	152	2,565	768	358	721	24	1,871	225	57	372	101	755
1892....	787	449	898	184	2,318	634	272	735	6	1,697	492	305	426	212	1,435
1893....	823	506	914	161	2,404	804	379	745	9	1,437	509	289	560	249	1,597
1894....	832	437	602	176	2,047	477	333	413	9	1,232	611	469	304	227	1,611
1895....	789	606	240	264	1,899	652	494	152	46	1,344	711	456	128	212	1,502
1896....	1,143	553	620	162	2,478	702	469	440	168	1,779	880	486	234	238	1,838
1897....	919	539	226	157	1,841	985	632	239	252	2,058	867	522	108	144	1,636
1898....	1,122	882	340	200	2,544	1,087	847	260	182	2,326	835	613	133	167	1,748
1899....	1,174	803	570	169	2,716	948	819	499	184	2,450	712	532	315	220	1,779
1900....	1,068	1,239	481	152	2,940	946	1,087	521	156	2,710	750	695	288	158	1,891
1901....	1,360	1,765	592	139	3,856	1,220	1,443	302	137	3,102	1,019	1,081	202	108	2,410
1902....	992	1,113	530	137	2,772	820	927	364	255	2,366	757	780	293	223	2,053
1903....	1,077	1,403	608	158	3,246	982	1,044	408	229	2,663	717	707	278	283	1,985
1904....	1,378	2,127	338	185	4,028	1,105	1,384	227	207	2,923	827	893	191	146	2,057
1905....	1,339	2,275	454	253	4,321	1,058	1,297	350	231	2,939	775	910	301	171	2,157

Fiscal year.	Lock No. 4, Green River.					Lock No. 5, Green River.					Lock No. 1, Barren River.				
	Steamboats.	Barges and flats.	Rafts.	Miscellaneous.	Total.	Steamboats.	Barges and flats.	Rafts.	Miscellaneous.	Total.	Steamboats.	Barges and flats.	Rafts.	Miscellaneous.	Total.
	No.	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*
1889....	115	49	41	51	256	.....	.....	.....	.....	.....	112	57	10	85	264
1890....	126	55	36	123	340	.....	.....	.....	.....	.....	23	20	8	13	64
1891....	399	141	87	134	761	.....	.....	.....	.....	.....	342	177	7	3	529
1892....	619	276	208	129	1,232	.....	.....	.....	.....	.....	565	180	36	80	861
1893....	553	333	292	144	1,332	.....	.....	.....	.....	.....	518	290	32	14	854
1894....	592	391	117	115	1,215	.....	.....	.....	.....	.....	534	347	22	42	945
1895....	866	471	54	116	1,507	.....	.....	.....	.....	.....	618	335	32	56	1,041
1896....	1,307	676	112	102	2,197	.....	.....	.....	.....	.....	859	351	15	36	1,261
1897....	1,249	820	53	53	2,175	.....	.....	.....	.....	.....	842	451	10	104	1,407
1898....	1,192	884	39	176	2,291	.....	.....	.....	.....	.....	789	553	1	86	1,429
1899....	1,073	828	159	141	2,201	.....	.....	.....	.....	.....	826	528	3	119	1,476
1900....	1,099	929	122	138	2,288	238	255	47	76	616	797	462	4	103	1,366
1901....	1,347	1,017	75	141	2,580	376	383	29	217	1,005	992	497	20	93	1,602
1902....	1,012	814	102	229	2,157	391	388	53	182	1,014	859	499	10	108	1,476
1903....	1,049	763	111	249	2,172	398	465	59	203	1,125	1,096	653	18	120	1,852
1904....	910	817	68	86	1,881	520	646	49	207	1,422	819	496	5	53	1,393
1905....	1,115	917	84	103	2,219	731	633	87	272	1,723	961	404	1	159	1,525

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Comparative statement of traffic and commerce, Green and Barren rivers, Kentucky—Continued.

COMMERCE.

Fiscal year.	Green River.					Barren River, Lock No. 1.
	Lock No. 1.	Lock No. 2.	Lock No. 3.	Lock No. 4.	Lock No. 5.	
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
1889						
1890						
1891						
1892						
1893						
1894						
1895						
1896						
1897						
1898	198,475	161,841	109,107	84,761		28,488
1899	257,104	184,895	84,189	43,973		43,504
1900	378,684	288,948	172,016	139,580	47,098	88,355
1901	452,522	295,744	183,512	117,054	57,058	46,445
1902	395,548	242,722	158,037	110,468	47,940	80,616
1903	457,386	259,142	165,746	106,119	59,525	48,738
1904	329,896	253,979	179,702	108,294	69,226	32,982
1905	466,015	308,274	257,181	157,208	107,848	88,486

List of boats plying on Green, Barren, and Rough rivers, Kentucky, during fiscal year ending June 30, 1905.

Name of boat.	Character.	Tonnage.	Name of boat.	Character.	Tonnage.
Wm. Preston Dixon	U. S. snag boat	200	T. W. Sweatt	Tow	12
Emerald	U. S. towboat	20	Nellie	do	11
Park City	Packet boat	198	Shiloh	do	11
Crescent City	do	194	Newburgh	do	10
Bowling Green	do	123	Duce	do	8
Chaperon	do	95	Phyto	do	8
Charlie Curlin	do	58	Levi	do	8
We Three	do	13	Jessie	do	7
Kalista	do	9	R. Nash	do	6
Water Lily	do	9	Dorothy	do	5
St. Clair	do	6	Alice L. Barr	Tugboat	50
Wilmot	Tow	169	J. B. A	do	50
Little Clyde	do	99	Edgar	do	37
City of Idaho	do	98	Ingleside	do	36
Mary Lacy	do	98	Lydia Wheeler	do	31
J. M. Bowell	do	94	Nannette	Pleasure	9
Frances	do	93	C. F. Drewes	do	5
D. A. Nisbet	do	85	Lily	do	5
Vincennes	do	81	Ray	do	4
Neptune	do	80	Trail	do	4
Mary Stewart	do	77	Progress	do	4
Martha H. Hennen	do	77	Leo	do	4
Kenois	do	69	Sea Lion	do	4
Enos Taylor	do	65	Superba	do	4
Isabella	do	65	Erdena	do	4
Old Reliable	do	64	Stella	do	4
Racket	do	60	Sweetheart	do	3
Eclipse	do	57	Son of a Gun	do	3
Allie	do	53	Josie S	do	3
Emma	do	53	Outcast	do	3
Thomas Parker	do	57	Wawa	do	2
Peerless	do	50	Tad	do	2
Samuel	do	48	Maud	do	2
Fawn	do	46	Skipper	do	2
Sunbeam	do	41	Hobo	do	2
Alma	do	41	Pearl	do	2
Anton Brucken	do	40	Geo. S	do	2
Sam O'Connor	do	40	Bertha K	do	2
Lotus	do	28	Martha	do	2
Norway	do	24	Ethel T	do	2
R. P. Hobson	do	22	Lena Bell	do	2
Mystic	do	9	Mark Twain	do	2
Cruiser	do	13	Nannie	do	2

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REPORT OF MR. W. S. OVERSTREET, MASTER.

UNITED STATES ENGINEER OFFICE.
Woodbury, Ky., June 30, 1905.

CAPTAIN: I have the honor to report the following work for the year ending June 30, 1905, under operating and care, etc., Green and Barren rivers, Kentucky, viz:

LOCK NO. 1, GREEN RIVER.

Valves.—On the afternoon of April 7, 1905, the second valve from the heel in the lower river gate became detached from the operating rod and could not be closed. After an unsuccessful effort by a diver from Evansville, Ind., one was procured from the Louisville and Portland Canal at Louisville, Ky., and without further trouble the valve was closed and the rod refastened, the work being accomplished on the night of the 9th. A heavier valve rod was put on another valve of this gate, and all attachments were carefully examined and made secure.

Miscellaneous.—The lock houses, warehouse, gates, flag pole, gauges, etc., were painted; snow, drift, weeds, etc., removed from the walls, cribs, gates, chutes, etc., as required; shade trees planted; fences whitewashed, and some sunken logs removed from the lock chamber.

LOCK NO. 2, GREEN RIVER.

Buildings.—The construction of the new cottage and office and warehouse was completed and a coal and wood house and brick closet built.

Cribs.—The second, fifth, and sixth sections of the upper river crib were rebuilt above pool level with beech timber; over the top of the cribs and across the spaces between them a continuous walkway 6 inches thick, 3 feet wide, 305 feet long, extending from the river wall of the lock to the upper end of this crib, was built.

The top courses of stringers and ties of the lower shore crib, which were loose and so decayed as to be unfit for refastening, were removed and replaced with a new course of stringers and ties of old sound material from stock on hand, the length of the crib repaired being 148 feet.

Dam.—Beginning at a point about 100 feet from the abutment side, 70 linear feet of the apron sheeting and top stringer, which had been torn away during the previous winter, was replaced with new beech timber and properly drift-bolted.

Fencing.—A picket fence 45 feet long, extending across the upper end of the reservation, and a new plank fence 1,040 feet long, extending the remainder of the way around the reservation, were built and whitewashed.

Miscellaneous.—The lock houses, warehouse, and outhouses, gates, flag pole, gauges, etc., were painted; snow, ice, drift, weeds, etc., removed from the walls, cribs, chutes, etc.; shade trees planted, and all material left from the construction of the new cottage and the office and warehouse transferred to Lock No. 4, Green River.

LOCK NO. 3, GREEN RIVER.

Buildings.—A new office and warehouse was constructed.

Fencing.—A new plank fence was built around the reservation on both sides of the river, the total length of new fence being 3,250 feet.

Miscellaneous.—The lock houses, office and warehouse, and outhouses, gates, flag pole, gauges, etc., were painted; snow, ice, drift, weeds, etc., removed from the walls, gates, cribs, etc.; shade trees planted; fences whitewashed; new check posts put in the bank above the lock, and all material left over from construction of the new warehouse transferred to Lock No. 4, Green River.

LOCK NO. 4, GREEN RIVER.

Miscellaneous.—The lock houses, main warehouse, and outhouses were painted; a brick flue built in the warehouse office; snow, ice, drift, etc., removed from the walls, cribs, gates, etc.; the gates, flag pole, gauges, etc., painted; shade trees planted, and minor repairs made to machinery, tools, etc.

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Dam.—The lower breast of the dam adjoining the abutment, which had been damaged through a distance of 96 feet by high water, was cut down to pool level and repaired with new timbers extending 20 feet into the dam, and the old sheathing securely renailed.

Fencing.—A wire fence was constructed around the reservation on the abutment side, its length being 750 linear feet. The wire and posts used in this construction being that saved from the reconstruction of the fencing on the lock side several years ago.

LOCK NO. 5, GREEN RIVER.

Drain.—The old drainpipe extending from the foot of the hill opposite the upper end of the lock to the branch below the reservation, a distance of 500 feet, was taken up and relaid, the lower end being diverted to the river at a point 80 feet below the lower end of the lock and just beyond the ell crib. The length of the new drain is 260 feet. The old drain was nearly level and in heavy rains was invariably choked with sand and gravel. The new drain has a fall of 5 feet. A wooden foundation was built under its lower end, and a timber flume 35 feet long, leading from its opening in the bank to the river through the first section of cribwork below the lock constructed.

Bank protection.—The bank on the abutment side of the river, beginning at a point 300 feet below the abutment and extending downstream 266 feet, with an average width of 70 feet, was riprapped with stone picked up along the banks of Green and Barren rivers. The total quantity of stone used in this work was 618 cubic yards and the area covered 1,770 square yards.

Fencing.—Three hundred and twenty linear feet of the fence across the lower end of the reservation was reconstructed.

Holes above upper wing wall.—On March 17, 1905, there appeared above the upper wing wall three sink holes, 30 or 40 cubic yards of earth disappearing therein. The width at the top of the largest hole was 15 feet. The holes were filled with brush, stone, and earth, and during the ensuing year an investigation and effectual remedy to prevent a recurrence will be applied.

Miscellaneous.—The banisters of the steps leading to the top of the hill, flag pole, gauges, gates, etc., were painted, cisterns cleaned, brick walks relaid, an outhouse built, minor repairs made to lockman's house, a brick flue built in the office, minor repairs made to the lower shore crib; snow, ice, drift, etc., cleaned from the walls, gates, cribs, chutes, etc., and the weeds cut from the reservation.

LOCK NO. 1, BARREN RIVER.

Dam.—In the fall of 1904 this dam was backed with 200 cubic yards of leaves and clay and 40 cubic yards of stone. During the month of June, 1905, 1,770 cubic yards of sand and gravel dredged from the channel of Barren River below Greencastle, Ky., was dumped on the old cofferdam, constructed last year to prevent leakage, on the abutment side of the dam. Steps to permanently stop the leakage at this dam will be taken during the coming year.

Fencing.—A new plank fence 910 feet long was built across the upper end of the reservation at this lock.

Miscellaneous.—The lock houses, gates, flag pole, gauges, etc., were painted; snow, ice, drift, etc., cleaned from the gates, walls cribs, chutes, etc.; shade trees planted, and weeds cut from the reservation.

SNAG BOAT WM. PRESTON DIXON.

This boat and its crew were engaged in building cofferdams and repairing valves and wickets at Lock No. 1, Rough River; in assisting in repairs to Dams Nos. 2 and 4, Green River, and cribs at Lock No. 2, Green River; in framing gate timbers for Lock No. 6, Green River; in unloading paving stone from Caden's quarry; in towing dredge from Lock No. 2, Green River, to Louisville, Ky.; in snagging in Wabash River, and in miscellaneous towing and snagging in Green and Barren rivers, Kentucky.

The machinery of this boat was overhauled; new guards, stationary fenders, and fantails put on; new stack knees, kevels, capstan beds, and bucket plank put in; the main deck patched, and new bed timbers put under shears. A summary of work done by the boat follows:

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As snag boat:	
Snags removed from Pool No. 1, Green River	169
Snags removed from Pool No. 2, Green River	52
Snags removed from Pool No. 3, Green River	82
Snags removed from Pool No. 4, Green River	890
Trees removed from Pool No. 4, Green River	23
Snags removed from Pool No. 5, Green River	41
Snags removed from Pool No. 1, Barren River	24
Trees removed from Pool No. 1, Barren River	1
Snags removed from Pool. No. 2, Barren River	20
Trees removed from Pool No. 2, Barren River	9
Miles run	1,145
As towboat:	
Barges towed	33
Derrick boats towed	25
Dredges towed	2
Quarter boats towed	4
Scows towed	2
Miles run	1,428
Miscellaneous:	
Trips made	10
Miles run	2,314

TOWBOAT EMERALD.

This boat and crew assisted in repairs to dam and cribs at Lock No. 2, Green River, in towing snagging outfit to Wabash River, in pumping out boats and barges, in miscellaneous minor work, and in towing and acting as dredge tender. A summary of work done follows:

As towboat:		
Barges towed		24
Derrick boats towed		11
Dredges towed		10
Quarter boats towed		2
Scows towed		17
Miles run		2,853
As dredge tender:		
Scows towed		136
Material towed	cubic yards	11,225
Miles run		62
Miscellaneous:		
Trips made		18
Miles run		832

Repairs were made to the sides, stack knees, main deck, deck beams, and wheel arms, a new head block put in, new seams calked, and the boat painted.

DREDGE NO. 1, GREEN RIVER.

This boat was placed in the dry dock at Louisville, Ky., and all unsound rake curves, rake plank, main bottom plank, gunwales, plank shear, and nosing removed and replaced with new sound material. All new seams were calked, spud frames were repaired, corner bands refitted, new boiler plate shaped and fitted on bow, and repairs made to machinery.

During the low-water season this boat was engaged in dredging as follows:

Lock No. 1, Green River:		
Upper approach, material removed	cubic yards	6,280
Lower approach, material removed	do	2,550
Lock No. 2, Green River:		
Upper approach, material removed	do	5,690
Lower approach, material removed	do	140
Lock No. 4, Green River:		
Lower approach, material removed	do	6,845
Lower approach, logs removed	number	159

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Lock No. 5, Green River:		
Lower approach, material removed	cubic yards	1,130
Lower approach, logs removed	number	35
Mouth of Rough River, Kentucky:		
Material removed	cubic yards	770
Stumps removed	number	4
Point above Edgars Ferry, Green River:		
Material removed	cubic yards	400
Logs removed	number	5
Elephant rock, Green River:		
Material removed	cubic yards	750
Island below Brownsville, Ky., Green River:		
Material removed	do	1,480
Stumps removed	number	17
Mouth Mud Creek, Barren River:		
Sunken barges removed	do	1
Jones Hole, Barren River:		
Material removed	cubic yards	90
Sunken barges removed	number	1
Bar below Greencastle, Barren River:		
Material removed	cubic yards	2,020
Boat Island, Barren River:		
Material removed	do	1,150
Cow Ford, Barren River:		
Material removed	do	150
Elevator, Barren River:		
Sunken barges removed	number	3
Wharf, Barren River, Bowling Green, Ky.:		
Material removed	cubic yards	250

This boat also assisted in repairs to cribs and dam at Lock No. 2, Green River.

BARGES NOS. 1 AND 2, AND DERRICK BOATS NOS. 1 AND 2.

These boats were placed on ways at Lock No. 4, Green River, and all rotten timber removed from rakes, gunwales, and bottoms, and replaced with new material. New framing was placed under the derricks of the derrick boats and the decks patched. Rotten timber heads on the barges were replaced with new ones. All seams in the bottoms and gunwales of the boats and new seams in the decks of the derrick boats were calked.

Very respectfully, your obedient servant,

W. S. OVERSTREET, *Master.*

Capt. H. BURGESS,
Corps of Engineers.

H H 8.

IMPROVEMENT OF ROUGH RIVER, KENTUCKY.

A complete synopsis of the projects under which the improvement of this river has progressed may be found on pages 2599 to 2602, Annual Report of the Chief of Engineers for 1899, and references to more extended information are given on page 501, Annual Report of the Chief of Engineers for 1904.

The work outlined in the existing project has been completed with the exception of snagging and removal of landslides as they occur.

No operations were in progress during the year. It is proposed to apply the available funds toward the construction of a derrick boat to be used for snagging and other purposes.

Commercial statistics are given in the following report for "Operating and care of lock and dam on Rough River, Kentucky."

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Money statement.

July 1, 1904, balance unexpended	$2,324.89
July 1, 1905, balance unexpended	2,324.89
July 1, 1905, outstanding liabilities	17.27
July 1, 1905, balance available	2,307.62

APPROPRIATIONS.

September 19, 1890	$25,000
July 13, 1892	15,000
August 18, 1894	22,500
June 13, 1896	43,000
Total	105,500

H H 9.

OPERATING AND CARE OF LOCK AND DAM ON ROUGH RIVER, KENTUCKY.

The estimate and project for the operation and care of this lock and its appurtenant structures during the fiscal year ending June 30, 1905, contained the following items, the funds for which were made available by allotment July 14, 1904:

Regular force	$750
Repairs, supplies, etc	550
Total	1,300

Expenditures during the year were for payment of lock tender, messenger service between the lock and nearest post route; for repairs to valve nearest the miter post of the lower river gate, minor repairs to the wickets of the upper gates; for new fencing about the grounds on the lock side of the river and reconstruction of fence about the abutment ground; for painting the lock gates, and other minor current repairs as needed.

Summary of expenditures on account of operating and care of Rough River, Kentucky, during the fiscal year 1905, showing general items and amount expended under each heading.

Items.	Amount.
Services	$893.06
Supplies	23.54
Materials	115.70
Miscellaneous	4.94
Total	1,037.24

ALLOTMENTS.

July 23, 1897	$2,086.00	July 20, 1903	$664.03
July 22, 1899	714.97	July 14, 1904	1,029.66
July 17, 1900	686.31		
July 10, 1901	763.66	Total	7,024.25
August 5, 1902	1,079.62		

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COMMERCIAL STATISTICS.

Statements of traffic and commerce passing Lock No. 1, Rough River, Kentucky, from July 1, 1904, to June 30, 1905.

TRAFFIC.

Kind of boat.	Number.	Tonnage.
Passenger	55	551
Tow	137	5,305
Barges	219	70,279
Small craft	126	257
Rafts	160	.....
Total	697	76,392

Total number of lockages during the fiscal year, 1,392.

COMMERCE.

Articles.	Quantity.	Articles.	Quantity.
	Tons.		*Tons.*
Corn	8	Lumber	224
Wheat	117	Timber	50,982
Salt	6	Ties, railroad	3,826
Oil	4	Miscellaneous	134
Flour	20		
Sugar	11	Total	55,338
Hay	1		

Number of passengers, 150.

For list of boats plying on this river, see page 1079 of this report.

Comparative statement of traffic and commerce at Lock No. 1, Rough River, Kentucky.

Fiscal year.	Traffic.					Commerce.
	Steamboats.	Barges and flats.	Rafts.	Miscellaneous.	Total.	
	No.	*No.*	*No.*	*No.*	*No.*	*Tons.*
1891	.....	.....	.....	.....	.....	98,161
1892	.....	.....	.....	.....	.....	50,000
1893	.....	.....	.....	.....	.....	75,000
1894	.....	.....	.....	.....	.....	64,401
1895	.....	.....	.....	.....	.....	36,945
1896	.....	.....	.....	.....	.....	30,445
1897	.....	.....	.....	.....	.....	16,538
1898	81	70	178	154	483	15,488
1899	164	29	207	132	532	21,831
1900	280	72	270	168	770	41,411
1901	175	114	121	247	657	20,666
1902	98	105	111	191	505	21,708
1903	128	76	133	235	572	32,919
1904	182	216	115	137	650	33,076
1905	192	219	160	126	697	55,338

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APPENDIX I I.

IMPROVEMENT OF RIVERS AND HARBORS ON LAKE SUPERIOR.

REPORT OF MAJ. CHAS. L. POTTER, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1905, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Harbor at Grand Marais, Minnesota.
2. Harbor at Agate Bay, Minnesota.
3. Harbor at Duluth, Minnesota, and Superior, Wisconsin.
4. Harbor at Port Wing, Wisconsin.
5. Harbor at Ashland, Wisconsin.
6. Harbor at Ontonagon, Michigan.
7. Waterway from Keweenaw Bay to Lake Superior, Michigan.
8. Harbor at Marquette, Michigan.
9. Harbor of refuge, Marquette Bay, Michigan.
10. Harbor of refuge at Grand Marais, Michigan.

HARBOR LINES.

11. DULUTH HARBOR, MINNESOTA.

UNITED STATES ENGINEER OFFICE,
Duluth, Minn., July 17, 1905.

GENERAL: In compliance with General Orders, No. 2, War Department, Office of the Chief of Engineers, Washington, April 13, 1905, I have the honor to transmit herewith my annual report of the works under my charge in the Duluth, Minn., district.

* * * * * * *

Very respectfully,

CHAS. L. POTTER,
Major, Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

I I 1.

IMPROVEMENT OF HARBOR AT GRAND MARAIS, MINNESOTA.

The object of the improvement is to provide a harbor for purposes of refuge and for commerce.

For a description of the harbor and of improvements accomplished,

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see Reports of the Chief of Engineers, United States Army, for the previous years. A small map of the harbor accompanies the report for 1903.

No work was done at this harbor during the past fiscal year.

The available balance will be applied to the maintenance of the work.

The village of Grand Marais is experiencing a healthy growth in population and general business, and gives promise of becoming a town of some commercial importance. The most important addition to its industries in recent years is the sawmill (mentioned in the last annual report), which began manufacturing lumber in August, 1904. It has a capacity of 60,000 feet of lumber per day of ten hours. Parties owning the sawmill have planned to build a wharf on the west side of the harbor for the shipment of lumber, and the present commercial wharf is to be extended. The Grand Marais Dock Company has applied to the Government for the establishment of a harbor line on a portion of the east shore.

Money statement.

July 1, 1904, balance unexpended	$316.41
Amount appropriated by river and harbor act approved March 3, 1905	2,000.00
	2,316.41
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	138.65
July 1, 1905, balance unexpended	2,177.76
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	2,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

ABSTRACT OF APPROPRIATIONS FOR IMPROVING HARBOR AT GRAND MARAIS, MINN.

March 1, 1879	$10,000	July 13, 1892	$10,000
June 14, 1880	10,000	August 18, 1894	3,000
March 3, 1881	20,000	June 3, 1896	3,000
August 2, 1882	20,000	March 3, 1899	30,000
July 5, 1884	10,000	June 13, 1902	2,000
August 5, 1886	10,000	March 3, 1905	2,000
August 11, 1888	15,000		
September 19, 1890	22,350	Total	167,350

COMMERCIAL STATISTICS.

Arrivals and clearances of vessels at Grand Marais, Minn., for calendar year 1904.

Arrivals	567
Clearances	567
Total	1,134
Net registered tonnage	396,900

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Freight received and shipped, 1904.

[In tons of 2,000 pounds.]

Receipts:	
Meats	222
Flour and mill stuffs	540
Grain	1,050
Coal	561
Miscellaneous merchandise	1,483
Lumber and shingles	787
Manufactured iron and brick	321
Live stock, 181 head	82
Total receipts	5,046
Shipments:	
Railroad ties, telephone, and telegraph poles	46,306
Square timber, pine	720
Pulpwood	8,550
Miscellaneous merchandise and raw furs	511
Lumber, 2,000,300 feet	3,000
Fish	107
Total shipments	59,194
Logs (towed) ---feet B. M.--	17,000,000
Passengers:	
Arriving ---number--	1,774
Departing ---do----	1,827
Total ---do----	3,601
Total receipts and shipments ---tons of 2,000 pounds--	64,240
Valuation of receipts and shipments	$1,179,902
Increase in freight over 1903 ---per cent--	82

There are no new lines of transportation.

I I 2.

IMPROVEMENT OF HARBOR AT AGATE BAY, MINNESOTA.

For a detailed description of this harbor see pages 2824–2825, Appendix K K, Report of the Chief of Engineers, United States Army, 1901, and earlier reports.

No work was done at this harbor by the United States during the fiscal year ending June 30, 1905.

In the matter of the suit brought by the United States attorney for the district of Minnesota in the United States district court against the Davidson Steamship Company for damages to the east breakwater, caused by the steamer *Shenandoah* in July, 1901, the first trial resulted in a verdict in favor of the United States for the full amount claimed.

On an appeal taken by the defendant a new trial was had in October, 1902, which resulted in disagreement of the jury. A third trial was held at the United States district court, Minnesota district, fifth division, in Duluth, October 21–27, 1903, and resulted in a verdict by the jury of $1,000 in favor of the United States.

The latter being unsatisfactory to the United States, a fourth trial was held in Duluth July 11–14, 1904, in which a verdict for the full amount claimed ($4,012.50) was obtained by the United States.

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Another hearing of this case is now pending before the United States court of appeals for the eighth circuit. This will be argued on the records of the previous trials.

The ore-shipping capacity of this harbor has been increased by the rebuilding of ore dock No. 3, and its extension for a distance of 480 feet, giving 80 additional ore pockets. Previous permission to build this extension was duly obtained from the Secretary of War, no harbor lines having been established.

The available balance, together with the appropriation recommended, will be expended in repairs to the breakwaters and for maintenance.

Money statement.

July 1, 1904, balance unexpended	$1,858.63
Amount appropriated by river and harbor act approved March 3, 1905	2,000.00
	3,858.63
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	790.06
July 1, 1905, balance unexpended	3,068.57
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	2,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

ABSTRACT OF APPROPRIATIONS FOR IMPROVING HARBOR AT AGATE BAY, MINNESOTA.

August 5, 1886	$22,500.00	March 3, 1899	$71,708.00
August 11, 1888	15,000.00	June 13, 1902	2,000.00
September 19, 1890	25,000.00	March 13, 1905	2,000.00
July 13, 1892	30,000.00	Miscellaneous	66.19
August 18, 1894	30,000.00		
June 3, 1896	50,000.00	Total	248,274.19

COMMERCIAL STATISTICS.

Statement of vessels arriving and departing at Agate Bay, Minnesota, for the calendar year 1904.

Steam	1,950
Tow	632
Total	2,582
Estimated tonnage	11,706,000
Increase	1,626,000

Receipts and shipments for 1904.

Receipts:	Tons.
Miscellaneous merchandise	101
Coal	161,857
Total	161,958

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Shipments:	Tons.
Iron ore	5,114,526
Lumber and forest products	73,709
Miscellaneous merchandise	100
Total	5,188,335
Total receipts and shipments	5,350,293

All tons are of 2,000 pounds.
Estimated value of freight received and shipped, 1904, $13,532,524.
There were no new lines of transportation established last year, but several new boats were added to the old lines.

I I 3.

IMPROVEMENT OF HARBOR AT DULUTH, MINNESOTA, AND SUPERIOR, WISCONSIN.

For the history of this harbor and the Government improvements, see Report of the Chief of Engineers, United States Army, 1901, Appendix K K, page 2828. A detailed description of the condition of channels and other improvements is given in Bulletin No. 15, issued April, 1905, from the office of the Survey of Northern and Northwestern Lakes, pages 44 to 54.

Removal of shoals.—Some shoaling having occurred in the Superior Harbor Basin and the Superior Front channel, caused by deposits from the Nemadji River, also some shoaling at the outer end of the Superior Entry, dredging was done during last season to remove same by contract with the Lake Superior Contracting and Dredging Company. The amount dredged from May 25 to June 30, 1904, was 24,050 yards, and from July 28 to completion of this contract, August 31, 1904, was 55,744 yards, making a total of 79,794 yards. The contract cost of this, at 12½ cents per yard, was $9,974.25. This removed the most important part of the above shoaling, including all of that in the entry. There remains a shoal in the north side of the harbor basin, to be removed at another time, which is marked, and will cause no inconvenience to navigation beyond slightly diminishing the effective size of the anchorage area.

Elsewhere in Duluth-Superior Harbor the channels have remained practically unchanged, as shown by soundings taken in the winter of 1904–5, except at two points where dredges have cut into the banks for the purpose of borrowing material for filling docks. The Duluth Canal shows some deepening by scour between the piers at the outer end.

The new Minnesota Channel, extending from Grassy Point to Spirit Lake, about 4 miles in length, has not shoaled to exceed a few inches at any point, although shoaling was feared. There have been no floods in the St. Louis River to test this channel since it was dug, and there is a liability of shoaling there when an extensive flood does occur, in particular on the curve in the channel near Big Island.

The channels of this harbor are now of such dimensions and so clean and well marked that steamers are getting to navigate them without the aid of tugs. For instance, the new large steamer *Augustus B. Wolvin*, 560 feet long, 56 feet wide, loaded with 10,937 tons of coal,

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and drawing 19 feet, came in through the Duluth Canal June 25, 1905, and proceeded up to the Zenith Furnace Company's dock at West Duluth, a distance of 8 miles by the channels, without assistance from a tug.

There has been some complaint, however, since the newest large freight vessels like the *Wolvin* came into use, of insufficient room for making the turn from the Government channel to the private slips at the ore docks in St. Louis Bay, and this brings up the question of the necessity of further dredging for widening channels in front of docks and slips, which may require additional funds in the near future, a matter that will be considered further.

Vessel yard.—The contract for the improvement of this Government property on Minnesota Point (described in the report of the Chief of Engineers, U. S. Army, 1904, Appendix I I, p. 2748) was commenced by Whitney Brothers Company in August, 1904, and completed January 3, 1905, at a contract cost of $16,658.20. This included the building of a bulkhead crib 14 feet wide, 18 feet deep, and 190 feet long; building a landing pier 14 feet wide by 20 to 24 feet deep and 389 feet long, running to the harbor line; dredging a slip 12 feet deep, 150 feet wide, and from the bulkhead out to deep water; filling the yard, 86 by 190 feet, with sand dredged from the slip and pier trenches; removing the United States buildings from the leased land at the foot of Seventh avenue west to the new yard, consisting of 1 warehouse, 20 by 60 feet, two stories high; 1 launch house, 27 by 30 feet; 1 boat house, 18 by 36 feet, and a brick oil house, 12 by 16 feet; building a board fence inclosing the yard and placing 15 iron mooring posts secured to the pier and bulkhead.

Change of harbor line.—The established harbor line in front of Minnesota Point, between Dundee street and Minnesota avenue, near the Duluth Canal, was changed July 20, 1904, by the Secretary of War so as to move the north end of this line out for a distance of 75 feet, while the south end at Dundee street remained unchanged. (See also Appendix I I 11.)

This change was made on account of the new vessel yard, to give an outlet from St. Louis avenue to the north, which has been made necessary by the closing up of this avenue where it crosses the Government slip. The city of Duluth vacated a portion of the avenue to allow the Government's improvements to be carried out.

Aerial Ferry.—The city of Duluth has erected a suspended car transfer, or aerial ferry, across the Duluth Ship Canal, in accordance with a revocable license granted by the Secretary of War, dated September 6, 1901, and an act of Congress approved February 7, 1902. The foundations were built in 1901–2, but nothing further was done at that time on account of failing contractors. Another contract was entered into by the city of Duluth and the Modern Steel Structural Company, of Waukesha, Wis., under which the superstructure was erected between the dates of July, 1904, and May 22, 1905.

The construction has been under the supervision of this office, and the requirements of the Government have been fully carried out.

The truss, which spans the channel, has a clear height of 138 feet above low-water datum, 137 feet above ordinary high water, and about 135 feet above the highest recorded stage of water in the harbor.

It is believed that any vessel on the Great Lakes can freely pass

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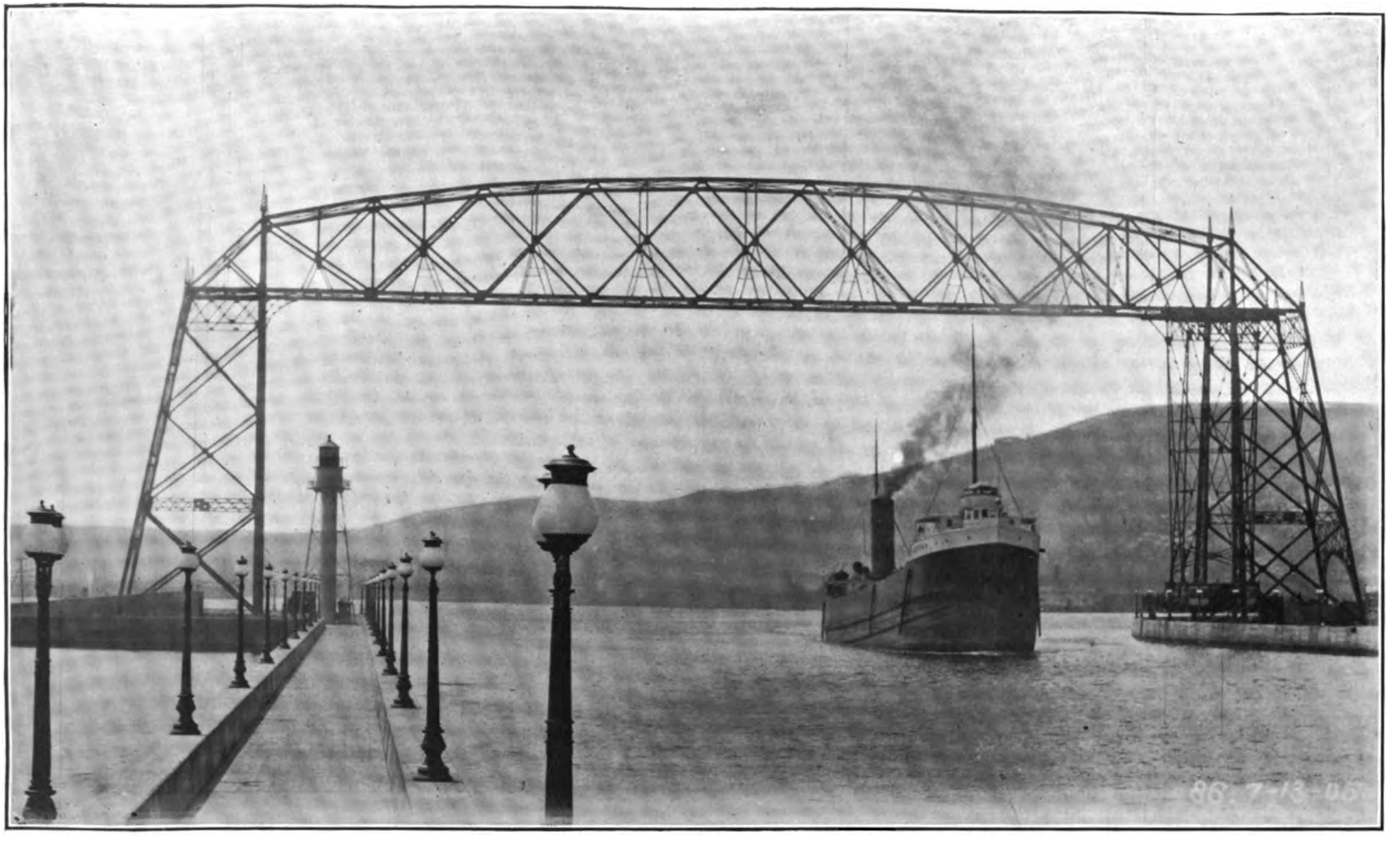

AERIAL FERRY AT DULUTH CANAL, LOOKING WEST.

The suspended car is at the right.

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under the bridge. The clear height is about the same as that of the New York-Brooklyn bridges.

The car, which is suspended from a truck running on an overhead track, reaches down to 13 feet above low water, and 3 feet above the concrete parapet of the Government piers.

The aerial ferry is operated by the city of Duluth under regulations drawn up by the engineer officer in charge of this district and approved by the Chief of Engineers, United States Army. These are as follows:

REGULATIONS FOR THE OPERATION OF THE AERIAL FERRY AT THE DULUTH SHIP CANAL.

1. *Lights.*—The car shall carry at night 2 red lights, in a vertical line one over the other, not less than 6 feet apart, and located over the center of the car at a height such that the lower light will be 26 feet above the water, and of such character as to be visible all around the horizon at a distance of at least 1 mile.

2. *Gong or bell.*—There shall be maintained on the car a loud sounding gong or bell, under control of the operator, such as can be heard distinctly at a distance of half a mile. A stroke on the gong shall be given one-half minute before starting from either side of the canal, and two strokes just before starting.

When the car is in motion during thick weather three strokes will be given as frequently as every fifteen seconds.

If at any time the car should come to a stop over the channel from failure of the motor or other cause, the gong shall be sounded continuously until the car shall be clear of the waterway.

In case the signal lights should for any reason be extinguished, the operator will use the gong signals prescribed for thick weather, until they are again relighted.

3. *Right of way.*—The car shall be run so as to give a clear channel to vessels, and shall always keep out of their way. No special signals will be required of vessels on account of this aerial ferry, but it is advised that when approaching the ferry in thick weather the whistle be sounded more frequently than one minute apart as prescribed by existing rules of navigation, so that the car operator can more correctly locate the vessel. Vessels are not expected to turn out for the car, except in case the car should be detained over the channel by accident.

The car shall not start on a trip across the channel when an approaching vessel which is moving at a moderate speed is within 500 feet of the car's course. In case the vessel is believed by the operator to have a speed of 8 miles an hour or greater, this distance should be increased to 600 feet or more, so as to make ample allowance for safety. On the other hand, in case of a tug towing a raft at the usual very low speed, the interval may be less than 500 feet.

The car shall in no case attempt to pass between two vessels of a tow.

4. *Revision of rules.*—These regulations are subject to revision as may be found necessary, due notice of which will be given previous to their taking effect.

5. *Motive power described.*—The car is propelled by an electric motor, which is placed under the floor of the car and turns a drum from which cables lead up to the overhead truck and then along the bridge to either tower. The motor is in duplicate, and two independent sources of electric current are available, either of which can be turned on quickly in case the other fails. There is a controller at each end of the car, and the operator is stationed at the forward end of the car. The time required for crossing the channel is expected to be about one and one-half minutes, but it may be run across in one minute, or less, judging from preliminary tests.

There is an additional and independent hand gear for propelling the car in case of failure of the electric motor. This moves the car much more slowly, and will be used only for the purpose of getting the car away from the channel in case of a breakdown.

CHAS. L. POTTER,
Major, Corps of Engineers,
In Charge of River and Harbor Improvements in Duluth, Minn., District.

Approved:

A. MACKENZIE,
Brig. Gen., Chief of Engineers.

WAR DEPARTMENT,
Washington, March 22, 1905.

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A ten-minute service was put into effect May 30, 1905, the car leaving each side every ten minutes between 6 a. m. and 9 p. m., making an interval of five minutes between single trips. From 9 p. m. until midnight there is a twenty-minute service, and from midnight until 6 a. m., a thirty-minute service.

The time required for a single trip is about one and one-fourth minutes, but it is stated that the car has crossed in forty-five seconds. The operation of this ferry has proven very satisfactory. The car is under good control, and there is apparently no difficulty in keeping out of the way of vessels.

This is the first aerial ferry to be built on the Western Continent, and is believed to be the only one in the world having a simple truss for its span and a trussed car suspender.

Cost of foundation, $8,000; superstructure and car, $100,000, and approaches $8,000, making the total cost $116,000.

Ornamental pier lights.—The city of Duluth continues the lighting of the Government piers at the canal, as described in the Annual Report of the Chief of Engineers for 1904, page 2747, using the posts and lamps furnished by the Government. The maintenance of these posts and lamps is proving somewhat expensive to the Government on account of breakage by vessels and storms, the annual cost amounting to some $400 or $500, and there is some question as to the advisability of continuing them in the future.

Life-preservers.—The Duluth Canal piers have been provided with six ring-preservers and lines, placed in suitable cases secured to the piers at convenient points; also two light portable life ladders for rescuing persons who may fall into the water.

Superior Entry.—The construction of the new concrete piers was actively continued after the close of the last fiscal year until September 21, 1904, when the entire amount of pier work laid out for that season was completed, comprising 1,584 feet in length of new pier, or a little more than half of the entire length of the south pier.

These concrete piers, which form the most important piece of work in this district at the present time, were described as to their general features in my report printed in the Annual Report of the Chief of Engineers for 1904, Appendix I I, pages 2748 to 2750. A detailed description of the method of construction was given in the report of Mr. Clarence Coleman, assistant engineer in charge of the Superior Entry work, printed in Appendix A A A of the Annual Report for 1904, and illustrated with plans and views.

An account of the operations for the last fiscal year are given in a report by Mr. Coleman accompanying herewith.

There was placed, during the season of 1904, 18,604 cubic yards of concrete, which is very nearly one-fifth of the total amount (94,000 yards) estimated for the entire work, but as the inshore portion which was included in last season's work is of smaller cross section than the outer portions the amount of pier built in linear feet is more than one-half of the length of the south pier and is nearly one-fourth of the total length of both of the proposed piers.

About 83.6 per cent of the concrete placed was below water, reaching to a depth of 21 feet below low water and about 22 feet below the prevailing stage during the work.

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The quality of the subaqueous concrete is very good as to hardness and surface finish, as shown by Mr. Coleman's examinations and tests.

No concrete has been placed this season as yet. The operations suffered a serious interruption by the destruction during a severe storm in May, 1905, of the outer portion of the pile protection dike, as narrated in Mr. Coleman's report herewith. This dike was built in the lake during the spring to inclose the portion of work laid out for construction during the present season, and is shown on Sheets I and XVIII of the plans which accompanied Mr. Coleman's report of 1904, above cited.

As will be seen by the details shown on Sheet XVIII, the dike consisted of a row of close-driven piles, flattened on two sides for better contact, and secured by wale timbers and machine bolts. It started in shallow water near shore and was built parallel to the proposed pier out into about 16 feet depth of water (at low water), thence northerly and westerly across the line of the new pier, in form of a letter A with its vertex toward the lake, and terminated in about 20 feet of water. It reached to a height of 6 feet above low water. The A portion was reenforced with 9 clusters of piles (although the plans show only 3 clusters), each cluster consisting of 7 piles firmly bound together with wire rope, except that the last cluster, in the deepest water, consisted of 12 piles instead of 7.

The portion of dike destroyed was that which stood in 10 feet or more of water. The dike here presented a wall 16 to 26 feet high to the attack of the waves, and failed by the piles breaking off near the bottom of the lake. The structure was simply too weak to resist such a storm as occurred on May 3.

The pile dike is now being replaced by a timber crib breakwater of ample strength, described in Mr. Coleman's report, and will be placed farther out in the lake so as to protect the entire south pier during construction. After the completion of the south pier it is proposed to raise the cribs, if possible, and place them in position to afford similar protection to the north pier during its construction.

Nemadji River Bridge.—The reconstruction of the Northern Pacific Railroad bridge across the Nemadji River in the city of Superior, Wis., was completed during or about the month of September, 1904. The new structure is a steel draw span with two clear openings of 65 feet each, and takes the place of a combination draw span with two channel openings of about 97 feet each.

Plans for the new bridge were approved by the Secretary of War under date of July 16, 1903, and the work was done under the supervision of this office.

Ore dock extension.—The Duluth, Missabe and Northern ore dock No. 3, in St. Louis Bay, has been extended 1,152 feet, and is now of the same length as No. 1 and No. 2, and reaches to the harbor line. It was completed June 1, 1905. This adds 192 ore pockets to the dock, and materially increases the facilities for the shipment of iron ore at this harbor.

Water and gas mains.—Under a license by the Secretary of War dated March 14, 1905, the board of water and light commissioners of the city of Duluth began in June, 1905, to lay a 12-inch water pipe

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and an 8-inch gas pipe across the canal and Government lands adjoining to supply Minnesota Point. The pipes have already been laid across the parks, and the placing of them under the north pier is about to be undertaken. The mains will not be laid across the bed of the channel until next winter, to avoid interference with navigation.

The work is under the supervision of this office.

The Superior Water, Light and Power Company laid a 6-inch gas main in October, 1904, across the channel of the St. Louis River at the site of the Northern Pacific Railroad bridge at Grassy Point, West Duluth, under a license from the Secretary of War dated October 1, 1903. This is for the purpose of supplying the city of Superior with gas produced at the Zenith Furnace Company's coke ovens, at West Duluth, as a by-product. The work was under the supervision of this office.

LAKE COMMERCE.

The system of vessel reports which was inaugurated in 1895 has been kept up, and the commercial statistics accompany this report. These are as accurate as is practically possible to make them, being compiled from the individual reports of each trip of every vessel, in or out, made directly to this office.

These data are considered of much value by the public, as evidenced by the great demand upon this office for copies from railroad corporations, vessel agencies, commercial organizations, publishers of trade and technical journals, and others, a demand which is increasing yearly. The reports are mimeographed in this office for gratuitous distribution.

Fifty-three per cent of the freight passing the Sault locks in 1904 was for Duluth–Superior Harbor.

NEED OF A HARBOR PATROL.

This harbor is now so large, with its 49 miles of established harbor frontage and 17 miles of improved 20-foot channels, and its commercial business so great, moving 17,000,000 tons of freight in the last season, that it is found impossible to prevent obstructions and enforce regulations without special supervision.

For example, the rules prescribed by the Secretary of War limit the size of rafts brought through the entrances and channels, but there is sometimes a disposition on the part of those in charge of the rafts to disregard these rules, and it is hard to enforce their observance with the means now at hand without resort to prosecutions, which is unsatisfactory, and generally fails to accomplish the purpose for which intended.

There is a United States watchman at the Duluth Canal who reports such violations, and he can do no more. He can not tell with certainty whether an approaching raft is too large until it enters between the piers, and then it is too late to stop it. What is needed in such a case is a tug, with a United States official and assistants aboard, to run out into the lake and meet the raft, measure its size, and, if found too large, require the towing crew to either reduce the size of the raft or bring it in through the other entrance.

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The passage of rafts through the harbor also requires watching to see that the channels are not blocked and vessels delayed. There has been an average of 103,000,000 feet of logs brought into this harbor annually, in rafts, during recent years.

There is more or less private dredging in progress each season in this harbor, and some of the dredge men are apt to dump improperly, if not watched, in or near channels, to save the time and cost of towing to the regular dumping grounds.

Refuse is liable to be deposited in channels, and ashes thrown out or pumped out of vessels into channels.

Encroachments on public channels by private persons, or corporations, building wharves beyond the established harbor lines require attention and checking.

Channels need to be examined from time to time, particularly after floods, to discover shoals and bars which would obstruct navigation.

Vessels sometimes anchor in basins or channels in such a way as to obstruct the passage of other vessels, or take up too much anchorage space.

It is evident that the prevention of obstructions and violations of rules can best be effected by the employment of special inspectors, empowered to arrest offenders, and provided with a steam tug and crew of men.

The necessity of a certain amount of dredging annually in order to maintain the channels of this harbor, which have been completed according to the approved project, has been stated in the Report of the Chief of Engineers, United States Army, 1901, Appendix K K, page 2829.

It is believed that it would be wise to provide for the current needs of this harbor—that is, for maintenance of Government improvements, prevention of willful obstructions and violations of rules, and for the collection of statistics of the lake commerce of this port—by a Congressional enactment authorizing allotments for this purpose to be paid from some permanent fund upon annual estimates made by the engineer officer in charge of the district, or by an item in an annual appropriation bill, as the needs for the maintenance of the harbor are too great to depend upon the uncertainty of river and harbor bills.

An approximate estimate of cost would be as follows:

Tug hire	$6,000
1 inspector, 2 deputy inspectors, 2 watchmen (at entrances); 6 laborers (for sounding through ice)	6,000
Dredging to remove shoals, from $10,000 to $30,000, depending on the occurrence of floods, say	20,000
2 vessel recorders (at entrances); 1 vessel recorder (in office); printing blanks, etc	3,000
Office expenses	5,000
Miscellaneous expenses, labor, material, etc	5,000
Total	45,000

After completion of work at Superior Entry a Government tug will be available for this work.

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Money statement.

July 1, 1904, balance unexpended		$240,874.73
Amount appropriated by river and harbor act approved March 3, 1905		270,000.00
		510,874.73
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$167,985.37	
For maintenance of improvement	25,000.00	
		192,985.37
July 1, 1905, balance unexpended		317,889.36
July 1, 1905, outstanding liabilities		25,000.00
July 1, 1905, balance available		292,889.36
July 1, 1905, amount covered by uncompleted contracts		75,000.00
Amount (estimated) required for completion of existing project		300,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$150,000.00	
For maintenance of improvement	50,000.00	
		200,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

ABSTRACT OF APPROPRIATIONS FOR IMPROVING HARBOR AT DULUTH, MINN., AND SUPERIOR, WIS.

June 3, 1896	$50,000.00	March 3, 1901 (sundry civil act)	$320,000.00
June 4, 1897 (sundry civil act)	437,500.00	June 28, 1902 (sundry civil act)	459,727.50
July 1, 1898 (sundry civil act)	770,138.00	June 13, 1902	200,000.00
March 3, 1899 (sundry civil act)	300,000.00	March 3, 1905	270,000.00
June 6, 1900 (sundry civil act)	793,187.50	Miscellaneous receipts	667.50
		Total	3,601,220.50

The following statement shows the manner in which the appropriations have been expended since June 30, 1896. The amount expended under the different classes of work includes the cost of soundings, superintendence, buoying, and contingencies:

Dredging	$2,133,833.71
Duluth canal piers	650,000.00
Wisconsin Entry piers	374,686.24
Purchase of land	107,061.19
Vessel yard construction	17,750.00
Total	3,283,331.14

ABSTRACT OF APPROPRIATIONS FOR IMPROVING HARBOR AT DULUTH, MINN.

March 3, 1871	$60,000.00	August 2, 1882	$45,000.00
June 10, 1872	50,000.00	July 5, 1884	45,000.00
March 3, 1873 (allotted)	36,049.20	August 5, 1886	56,250.00
June 23, 1874	10,000.00	August 11, 1888	80,000.00
March 3, 1875	35,000.00	September 19, 1890	100,000.00
August 14, 1876	15,000.00	July 13, 1892	125,000.00
June 18, 1878	30,000.00	August 18, 1894	75,000.00
March 3, 1879	25,000.00		
June 14, 1880	25,000.00	Total	852,299.20
March 3, 1881	40,000.00		

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The following statement shows the manner in which the appropriations have been expended. The amount expended under the different classes of work includes the cost of soundings, superintendence, buoying, and contingencies.

Total amount expended to June 30, 1897:	
Breakwater	$110,000.00
Dredging	644,638.55
Canal piers, etc	97,660.65
Total	852,299.20
Expended prior to present project:	
Breakwater	110,000.00
Canal piers, etc	45,698.33
Dredging	122,354.05
Total	278,052.38
Expended under the project adopted in 1881:	
Canal piers, etc	51,962.32
Dredging	522,284.50
Total	574,246.82

ABSTRACT OF APPROPRIATIONS FOR IMPROVING HARBOR AT SUPERIOR BAY AND ST. LOUIS BAY, WISCONSIN.

March 3, 1867	$63,000.00	June 14, 1880	$5,000.00
April 10, 1869	45,000.00	March 3, 1881	10,000.00
July 7, 1870	40,000.00	August 2, 1882	40,000.00
March 3, 1871	60,000.00	July 5, 1884	45,000.00
June 10, 1872	50,000.00	August 5, 1886	22,500.00
March 3, 1873 (allotted)	63,950.80	August 11, 1888	50,000.00
Allotted from appropriations for "Repairs of Harbors on Northern Lakes"	5,433.00	September 19, 1890	65,000.00
		July 13, 1892	70,000.00
		August 18, 1894	50,000.00
August 14, 1876	3,000.00	Total	695,883.80
June 18, 1878	3,000.00		
March 3, 1879	5,000.00	Aggregate	5,149,403.50

EXPENDITURES.

Amount expended under original project, adopted in 1867	$258,000.00
Amount expended under project recommended by Board of Engineers in 1873	77,513.26
Amount expended under present project to June 30, 1897	360,370.54
Total	695,883.80

The following statement shows the manner in which the appropriations have been expended. The amount expended under the different classes of work includes the cost of examination, soundings, superintendence, buoying, and contingencies.

Repairs and beach protection	$13,233.00
Construction and repair to piers	334,278.64
Dredging	348,372.16
Total	695,883.80

LIST OF EXISTING CONTRACTS.

Contract was entered into with the Illinois Steel Company, of Chicago, Ill., dated January 30, 1903, approved by Chief of Engineers February 21, 1903, for furnishing 65,000 barrels of Portland cement for Superior Entry piers, south side,

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at $2.17 per barrel, delivered in sacks (four sacks to the barrel), less 10 cents each for sacks returned. Delivery to commence May 1, 1903, and be completed by September 15, 1904. Time of completion waived for a reasonable period by indorsement of the Chief of Engineers, dated October 4, 1904.

Contract was entered into with George A. Wieland, of Duluth, Minn., dated June 15, 1903, approved by Chief of Engineers July 9, 1903, for furnishing and delivering in stock pile at Superior Entry, Wisconsin, 43,000 cubic yards of pebbles or gravel at $1.08½ per cubic yard. Delivery to commence July 1, 1903; to continue at rate of 5,200 cubic yards per month during season of navigation, making a total of 20,800 cubic yards to be delivered during season of 1903. During season of 1904 delivery to be at rate of 5,550 cubic yards per month until 22,200 cubic yards have been delivered. Time of completion waived for a reasonable period by authority of Chief of Engineers, dated September 26, 1904 (E. D. 46811/19).

Contract was entered into with the Lake Superior Contracting and Dredging Company, of Duluth, Minn., April 17, 1905, approved by Chief of Engineers April 28, 1905, for dredging about 48,000 cubic yards of sand and 1,000 cubic yards of rock from pier trench at Superior Entry, Wisconsin, at rate of 25 cents per cubic yard for the sand and $1 per cubic yard for the rock and $25 per hour for the use of plant; work to commence within ten days after notice of approval of contract by Chief of Engineers, and be completed within thirty working days thereafter. Time of completion waived for a reasonable period by indorsement of the Chief of Engineers dated May 29, 1905.

COMMERCIAL STATISTICS, DULUTH, MINN.

Comparative statement of arrivals and clearances for calendar years 1903 and 1904.

Year.	Arrivals.	Clearances.	Total.	Tonnage.	Average tonnage.
1903	4,308	4,343	[a] 8,646	13,678,026	[b] 1,758
1904	3,618	3,674	[c] 7,292	11,491,355	[b] 1,774
Increase or decrease	−685	−669	−1,354	−2,186,671	+16

[a] Steam, 7,439; tow, 1,207. [b] Exclusive of tugs. [c] Steam, 6,201; tow, 1,091.

Principal domestic commodities received and shipped by lake, 1904.

[Tons of 2,000 pounds.]

	Tons.
Receipts:	
Coal	1,350,544
Cement and limestone	79,650
Building stone, sand, etc	15,852
Salt, oil, etc	34,506
Manufactured iron and machinery	26,798
General merchandise and fish	96,954
Lumber	4,168
Poles, ties, etc	9,109
Total	1,617,581
Shipments:	
Wheat	250,836
Other grains	308,019
Flour	113,392
Iron ore	5,147,028
Copper	748
Wool	2,307
Lumber, shingles, and laths	551,853
General merchandise	29,248
Miscellaneous	3,307
Total	6,406,738

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RECAPITULATION.

	Tons.[a]	Valuation.[b]
Total receipts	1,617,581	$24,296,264
Total shipments	6,406,738	50,413,895
Receipts and shipments	8,024,319	74,710,159

[a] These figures do not include some 38,620,000 feet of logs in rafts.
[b] Valuations are based on average wholesale prices on board vessels for exports and landed on wharves for imports.

Passengers arriving	32,862
Passengers departing	34,304
Total	67,166

Receipts of coal and shipments of flour, 1904.

	Tons.
Coal	1,350,544
Flour	113,392

The storage capacity of Duluth-Superior elevator system is 34,375,000 bushels, and that of Duluth elevators proper 16,500,000.

The shipments of wheat from Duluth-Superior Harbor for the year 1904 were 602,021 tons.

There was less Canadian grain shipped via Duluth-Superior in 1904 than in previous year.

Average net registered tonnage, 1904, Duluth and Superior, exclusive of tugs, 1,914.

Arrivals and clearances of vessels at Duluth, 1904.

Arrived	3,618
Cleared	3,674
Total	7,292

Imports and exports, 1904.

Imports	$144,721.00
Duties	17,567.23
Value of domestic exports	674,912.00
Value of foreign exports	2,707.00

All cargo tons are of 2,000 pounds.

Number of vessels of all kinds enrolled at Duluth custom-house up to June 30, 1905, 359; total gross registered tonnage, 577,535. Decrease of 3 vessels under 1904.

Detailed statement of arrivals, clearances, and registered tonnage of vessels at Duluth for the calendar year 1904.

Month.	Arrived.	Cleared.	Total.	Net registered tonnage.
January	3	3	6	894
May	144	135	279	127,336
June	417	450	867	1,160,531
July	668	688	1,346	2,158,796
August	610	616	1,226	1,976,819
September	507	529	1,036	1,816,961
October	573	559	1,132	2,054,648
November	543	557	1,100	1,794,728
December	158	142	300	400,642
Total	3,618	3,674	7,292	11,491,355

Total tons cargo received through Duluth Canal	4,037,608
Total tons cargo departing through Duluth Canal	7,113,297
Total	11,150,905

Many tugs passed in and out of Duluth Canal with dump scows, light, or with vessels in tow, which are not included in the above table.

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Receipts and shipments, with valuations, for the calendar year 1904—Duluth and Superior combined.

Description of cargo.	Quantity.	Unit price.	Valuation
Barley, oats, rye, corn ..... bushels	13,502,256	$0.50	$6,751.12
Cement ..... barrels	164,761	1.40	230.66
Coal:			
Hard ..... tons	827,878	6.25	5,174.23
Soft ..... do	3,064,972	3.65	11,187.14
Copper ..... do	21,417	265.00	5,675.56
Fish ..... do	1,487	75.00	111.55
Flaxseed ..... bushels	13,201,145	1.17	15,445.34
Flour ..... barrels	3,604,867	5.50	19,826.76
General merchandise ..... tons	182,140	165.00	30,053.10
Gravel ..... cubic yards	40,380	1.00	40.38
Iron, manufactured ..... tons	50,688	65.00	3,294.72
Iron ore ..... do	9,860,547	2.20	21,693.20
Laths ..... M	31,396	2.50	78.49
Limestone ..... tons	74,900	1.50	112.35
Logs, pine ..... M feet	39,020	12.00	468.24
Lumber:			
Hemlock ..... do	1,674	14.00	23.43
Pine ..... do	367,894	15.25	5,914.30
Machinery ..... tons	1,113	300.00	333.90
Oil ..... barrels	115,742	6.75	781.25
Oil cake ..... tons	4,711	27.00	127.17
Piles ..... number	6,818	2.30	15.68
Poles ..... do	76,021	1.40	106.42
Posts ..... do	58,284	.10	5.82
Salt ..... barrels	342,551	.70	239.78
Sand ..... cubic yards	13,608	.50	6.80
Shingles ..... M	407,250	2.50	1,018.12
Stone, building ..... tons	15,061	5.00	75.30
Ties, railroad ..... number	157,378	.40	62.95
Wheat ..... bushels	20,067,365	1.04	20,870.05
Wool ..... tons	7,478	1,000.00	7,478.00
Miscellaneous items not included in above			31.36
Total valuation			157,233.20

Commerce for the head of the Lakes (Duluth, Minn., and Superior, Wis., combined) for the calendar year 1904.

[Tons of 2,000 pounds.]

Receipts:	Tons.	Shipments:	Tons.
Soft coal	3,063,849	Iron ore	9,860,547
Hard coal	827,878	Copper	21,402
Limestone	74,900	Flour	360,486
Salt	48,936	Wheat	602,025
Machinery	713	Flax	369,633
Manufactured iron	50,435	Other grains	337,557
Oil	23,147	Wool	7,478
General merchandise	145,345	Lumber	580,487
Lumber	5,149	Shingles	40,720
Ties and posts	10,200	Lath	7,848
Poles and piles	10,867	General merchandise	36,785
Fish	1,487	Iron and machinery	653
Cement and lime	33,477	Miscellaneous	7,575
Building stone	15,411		
Sand and gravel	71,977	Total	12,233,200
Miscellaneous	40		
Total	4,383,811		

Total cargo entered and departed	tons	[a]16,617,017
Valuation		$157,233,200
Total arrivals and departures		11,761
Net registered tonnage		19,879,783

[a] Does not include 39,020,000 feet B. M. logs in rafts.

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Arrivals and clearances of vessels at Superior, Wis., for 1904.

Steam	4,012
Tow	457
Total	4,469
Arrivals and clearances (not including dump scows which passed in and out of Wisconsin Entry)	2,158
Average net tonnage of vessels (exclusive of tugs)	2,146
Net tonnage, Wisconsin Entry	4,319,538

Vessel report for Superior Harbor for calendar year 1904.

ENTERING.

	Boats.	Net registered tonnage.	Tons of cargo.
Number which entered Superior Harbor loaded via Duluth Canal	877	1,756,745	2,430,106
Number which entered Superior Harbor light via Duluth Canal	419	713,041	.....
Number which came in Wisconsin Entry and discharged at Superior	246	179,479	[a] 336,124
Number which entered Wisconsin Entry light or with rafts in tow	691	1,497,068	.....
Total	[b] 2,233	4,146,333	2,766,230

DEPARTING.

Number which took cargo from Superior and departed through Duluth Canal	443	743,820	799,098
Number which left Superior light and departed through Duluth Canal	326	815,581	.....
Number which loaded at Superior and departed through Wisconsin Entry	1,023	2,508,470	[c] 5,027,372
Number which left Superior light and took cargo on at Duluth and departed via Duluth Canal	246	580,664	.....
Number which departed through Wisconsin Entry light or with booms in tow	198	143,610	.....
Total	[b] 2,236	4,242,095	5,826,468

[a] These figures do not include 28,200,000 feet of logs towed in through the entry by tugs.

[b] These figures do not include tugs which passed in and out of the entry with dump scows or with vessels in tow.

[c] These figures do not include 103,416 tons loaded at Duluth.

Receipts and shipments by lake of leading articles during the calendar year 1904 at Superior Harbor.

Receipts:	Tons.
Coal	2,541,183
Building stone and rubble	11,511
Salt	15,570
Manufactured iron and machinery	24,350
Oil and miscellaneous	22,097
General merchandise	49,823
Ties, poles, etc	11,958
Cement, limestone	28,727
Sand, gravel, and lumber	61,006
Total	[a] 2,766,230

[a] Not including logs.

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Shipments:	Tons.
Iron ore	4,713,519
Copper	20,654
Flour	247,095
Wheat	351,185
Other grains	399,168
Wool	5,171
Lumber	55,093
Shingles and lath	22,109
General merchandise	7,547
Miscellaneous	4,927
Total	5,826,468

RECAPITULATION.

	Tons.	Valuation.
Total receipts	2,766,230	$21,844,349
Total shipments	5,826,468	60,678,701
Total receipts and shipments	8,592,698	82,523,050

Passengers departing	2,568
Passengers arriving	2,844
Total	5,412

Detailed statement of arrivals and clearances of vessels, Superior, Wis., for the calendar year 1904.

Month.	Arrived.	Cleared.	Total.	Net registered tonnage.
May	62	74	136	121,221
June	293	307	600	997,849
July	406	399	805	1,422,695
August	428	413	841	1,458,264
September	310	317	627	1,277,535
October	370	364	734	1,500,856
November	313	321	634	1,397,810
December	51	41	92	242,198
Total	2,233	2,236	4,469	8,388,428

Average net tonnage per vessel, exclusive of tugs, 2,146.

Of the number reported for 1904, the steamers were divided as follows:

All freight	3,153
Passenger and freight	158
Excursion	128
Tugs	573
Total	4,012

DULUTH-SUPERIOR HARBOR FOR THE CALENDAR YEAR 1904.

Total vessel freight received and shipped, 16,617,017 tons of 2,000 pounds, valued at $157,233,209.

Increase in freight tonnage over 1890, 483 per cent.

Decrease in freight tonnage during the past year, 8.1 per cent.

It is impossible to give precise figures of the marine commerce of the principal ports of the United States for comparison with Duluth-Superior Harbor, for the reason that at ocean ports of the United States, as well as of foreign countries, no record of domestic tonnage is kept at the custom-houses, whereas on the Great Lakes a record is kept of the total marine commerce, both foreign

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Diagram Showing Freight Rec

Calendar Years 1903 and 1904

Dotted Lines repr

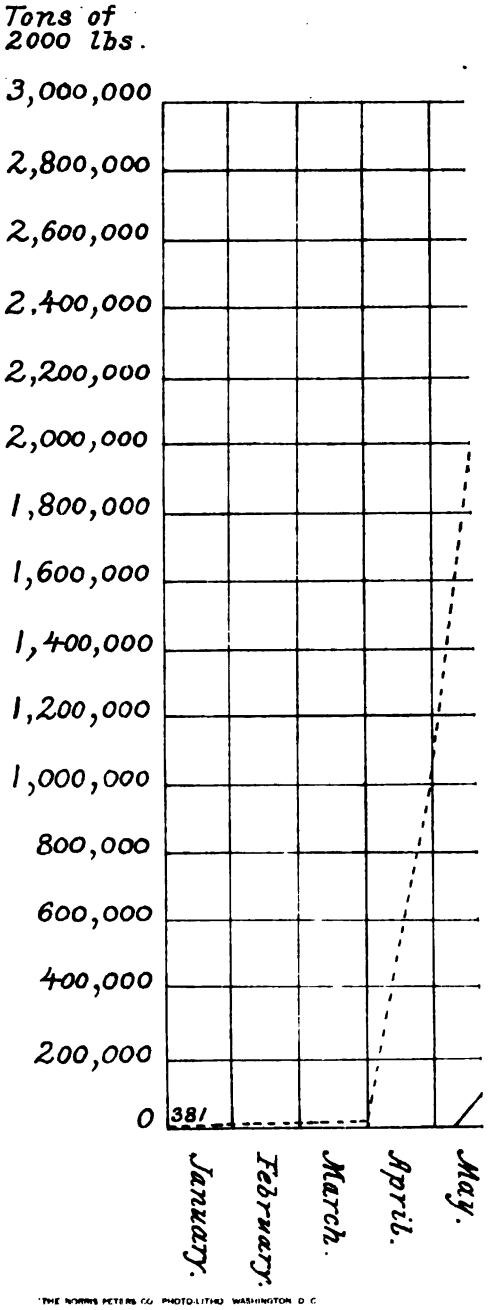

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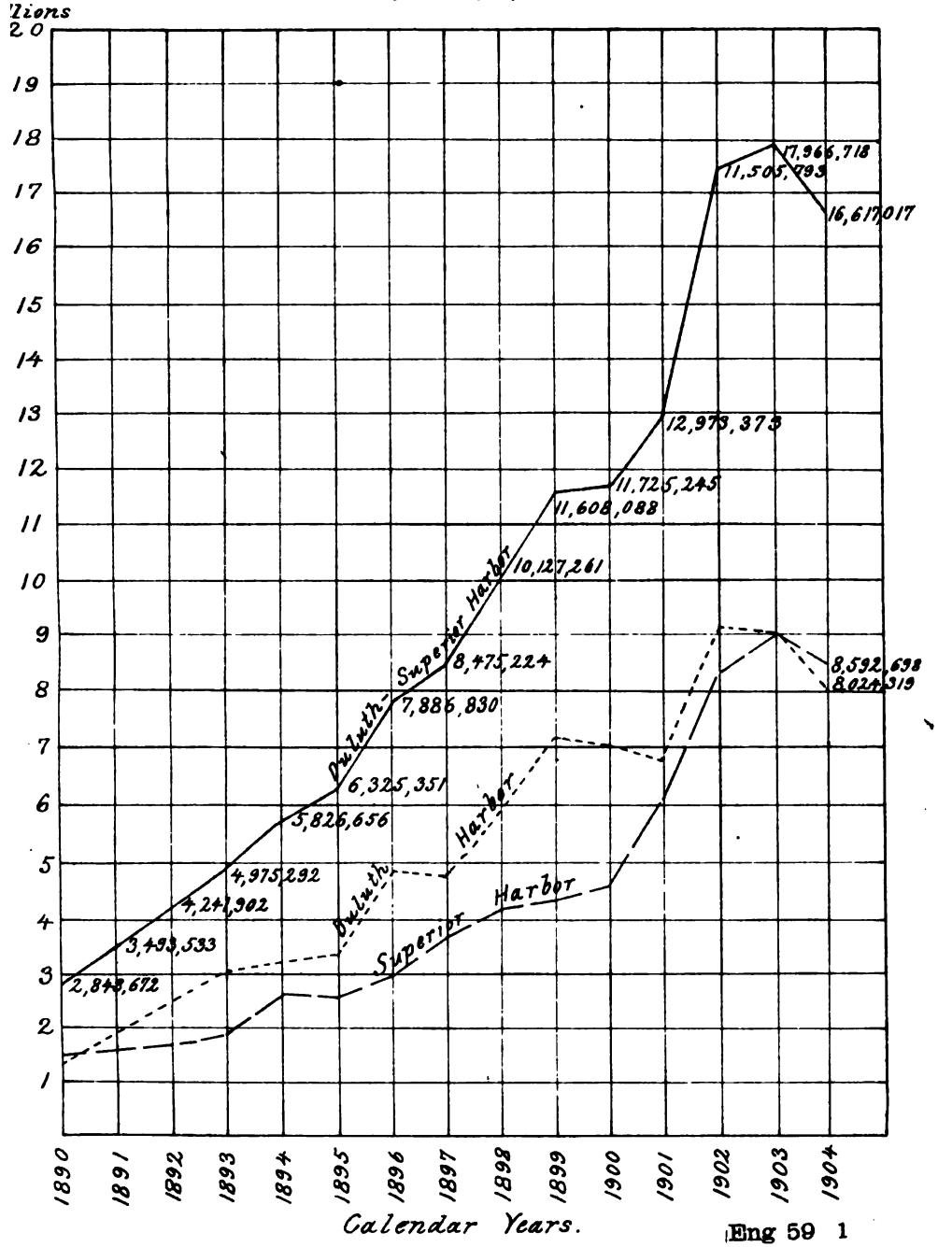
Diagram Showing Vessel Freight Received and Shipped, 1890 to 1904,

of Lbs. For Harbors of Duluth and Superior, Separately, and for the Two Combined.



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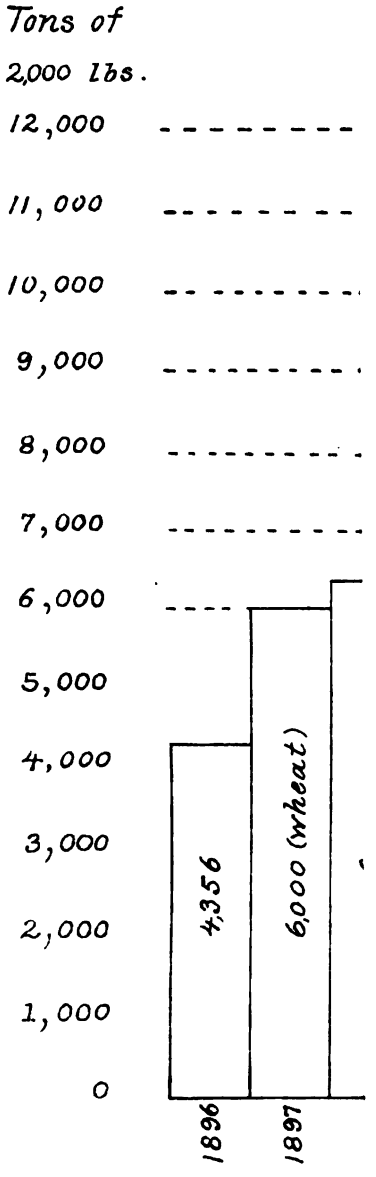
Largest Cargoes Received at

from 189



Cargoes were all iron ore
The largest cargo receive

THE HORRIS PETERS CO. PHOTO-LITHO WASHINGTON D C

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and domestic. In the principal ocean ports of the United States the tonnage of the local and coastwise (domestic) marine commerce is several times greater than that of the foreign.

Any comparison, therefore, of the relative marine commerce of lake and ocean ports based solely upon custom-house records is, for the reason just stated, incorrect and misleading.

The navigation season for Duluth-Superior Harbor averages only about eight months per annum, while for the ocean ports navigation is carried on during twelve months. Considering the mean monthly freight movement during the season of navigation, Duluth-Superior Harbor practically stands next to New York.

The total amount of freight received and shipped in 1903 was 17,966,718 tons; that for 1904 was 16,617,017 tons. The decrease in 1904 is due to two causes, viz, the late opening of navigation and the strike of the Vessel Masters' Association. By an inspection of the accompanying diagram (showing the movement of freight by months) it will be seen that during April and May, 1904, there was practically no freight moving and that the movement of freight for June was not up to the normal. The strike was settled in June, and from that time until the close of the season a greater amount of freight was received and shipped each month than during the corresponding months of 1903, but the increase was not sufficient to make up the shortage.

REMARKS ON THE COMMERCE OF DULUTH-SUPERIOR HARBOR FOR 1904.

Vessel tonnage.—Net registered tonnage is used, and is obtained from vessel reports made to this office and checked by official marine directories.

Valuations.—Freight valuations were obtained from the various trade journals, commercial records, and the principal wholesale dealers, and are based on average wholesale prices on board vessels for exports and landed on wharves for imports.

Cargo received.—4,037,608 tons of cargo were received through the Duluth Canal, and 346,203 tons, not including logs, through the Wisconsin Entry; 28,200,000 feet B. M. of logs came through the Wisconsin Entry, of which amount 27,800,000 feet B. M. came to Duluth.

Cargo departing.—7,113,297 tons of cargo departed through the Duluth Canal and 5,119,909 tons through the Wisconsin Entry. Of the latter amount, 103,416 tons were loaded at Duluth.

Cargo tons.—All freight tons used in this report are of 2,000 pounds.

Hard coal shows a decrease of 169,855 tons under 1903.

Soft coal shows a decrease of 155,826 tons under 1903.

Wheat and other grains show a decrease of 5,644,734 bushels, with a valuation of $450,839 more than in 1903.

Iron ore, a decrease of 526,910 tons under 1903.

The total freight traffic of 16,617,017 tons shows a decrease of 1,349,701 tons under 1903, with a valuation of $20,367,003 less than in 1903.

Wisconsin Entry.—There was an increase of 241,613 net registered tons and 402,763 freight tons over 1903.

The total number of passengers arriving and departing was 72.578. a decrease of 16,503 under 1903 and an increase of 36,776 over 1895.

A part of the large number of passengers is due to the local excursion business.

Average net registered tonnage recorded at Duluth, exclusive of tugs, 1,774.

Vessels recorded at Duluth Canal were: Entering, 3,426; departing, 3,147; net registered tonnage of vessels entering, 5,541,636; net registered tonnage of vessels departing, 4,651,370; total number of vessels entering and departing, 6,573; total net registered tonnage of vessels entering and departing, 10,193,006.

Average net registered tonnage of vessels arriving at and departing from Superior, exclusive of tugs, was 2,146.

Vessels recorded at Wisconsin Entry were: Entering, 940; departing, 1,218; total, 2,158; net registered tonnage of vessels entering, 1,671,552; departing, 2,647,986; total, 4,319,538.

Average number of tons cargo received per day at Duluth and Superior, 20,202.

Average number of tons of cargo shipped per day from Duluth and Superior, 56,098.

The navigation season covered a period of two hundred and seventeen days. This is reckoned from the first departure or arrival to the last departure or arrival bound to or from the lower lakes. The open season for Duluth-Superior

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Harbor to and from Lake Superior ports only was much longer, as some local boats ran all but three months of the year.

Duluth Canal.—First boat departed for lower lakes May 14. First boat entered from lower lakes May 12.

Last boat departed for lower lakes December 10. Last boat arrived from lower lakes December 14.

North-shore boats were running at close of calendar year.

Wisconsin Entry.—First boat arrived from lower lakes May 12. First boat departed for lower lakes May 16.

Last boat arrived from lower lakes December 8. Last boat departed for lower lakes December 10.

NEW LINES OF TRANSPORTATION, DULUTH-SUPERIOR, 1905.

Boutell Steel Barge Company, Bay City, Mich., 4 steamers, 8 barges. (Part of whaleback fleet of Pittsburgh Steamship Company.)
Mahoning Steamship Company, Cleveland, Ohio, 1 steamer.
Ohio Steamship Company, Cleveland, Ohio, 1 steamer.

Additions to existing lines.

Acme Steamship Company, 1 new steamer.
Anchor Line, 1 new steamer.
A. Booth & Co., 3 steamers (White Line fleet).
Kinsman Transit Company, 1 new steamer.
Lehigh Valley Transportation Company, 1 new steamer.
Mitchell & Co., 1 new steamer.
Pickands, Mather & Co., 1 new steamer.
Pittsburgh Steamship Company, 4 new steamers. Sold 16 small boats.
Presque Isle Transportation Company, 1 new steamer.
G. A. Tomlinson, 5 new steamers.
Robbins Transportation Company, 1 new steamer.
Lyman C. Smith Transportation Company, 1 new steamer.
Western Transit Company, 1 new steamer.

REPORT OF MR. CLARENCE COLEMAN, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Duluth, Minn., June 30, 1905.

MAJOR: I have the honor to submit herewith my report of operations under your direction and my charge in connection with the construction of the concrete piers at Superior Entry, Wisconsin, for the fiscal year ending June 30, 1905.

As a part of and accompanying this report are eight photographs,[a] showing different stages of the work, adaptation of the plant, etc.

The plant and processes of this work have been described in Report of the Chief of Engineers for 1904, Appendix A A A 19, pages 3779 to 3802.

From the close of the fiscal year ending June 30, 1904, to September 21, 1904, a total of 66 subaqueous blocks and 123 superstructure blocks were built in place. The volume of concrete in place amounted to 10,496.57 cubic yards for the subaqueous work and 3,049.68 cubic yards for the superaqueous work, or a total of 13,546.19 cubic yards. The south pier, as partly completed to this date, is 1,584 feet in length, contains 99 subaqueous blocks and 123 superaqueous blocks, with a total of 18,604.45 cubic yards of concrete in place. Of the entire amount of concrete built in place, 83.6 per cent is below the water level. No serious difficulties were encountered in this novel construction, and the plant as designed and built performed well the various functions for which it was intended.

The total running time of the concrete mixer during the fiscal year was 25,198 minutes, and total concrete in place 13,546.19 cubic yards. This shows a rate of 1 cubic yard every 1.86 minutes, or a rate of 258.07 cubic yards for every eight-hour day of actual working time. The mixing, transportation, and depositing plant has been fully described in Appendix A A A 19, page 3784, Report of the Chief of Engineers, United States Army, 1904.

It may be of interest to state that notwithstanding the large amount of concrete molded in place under the water and the number of operations required to

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[a] Four only are printed.

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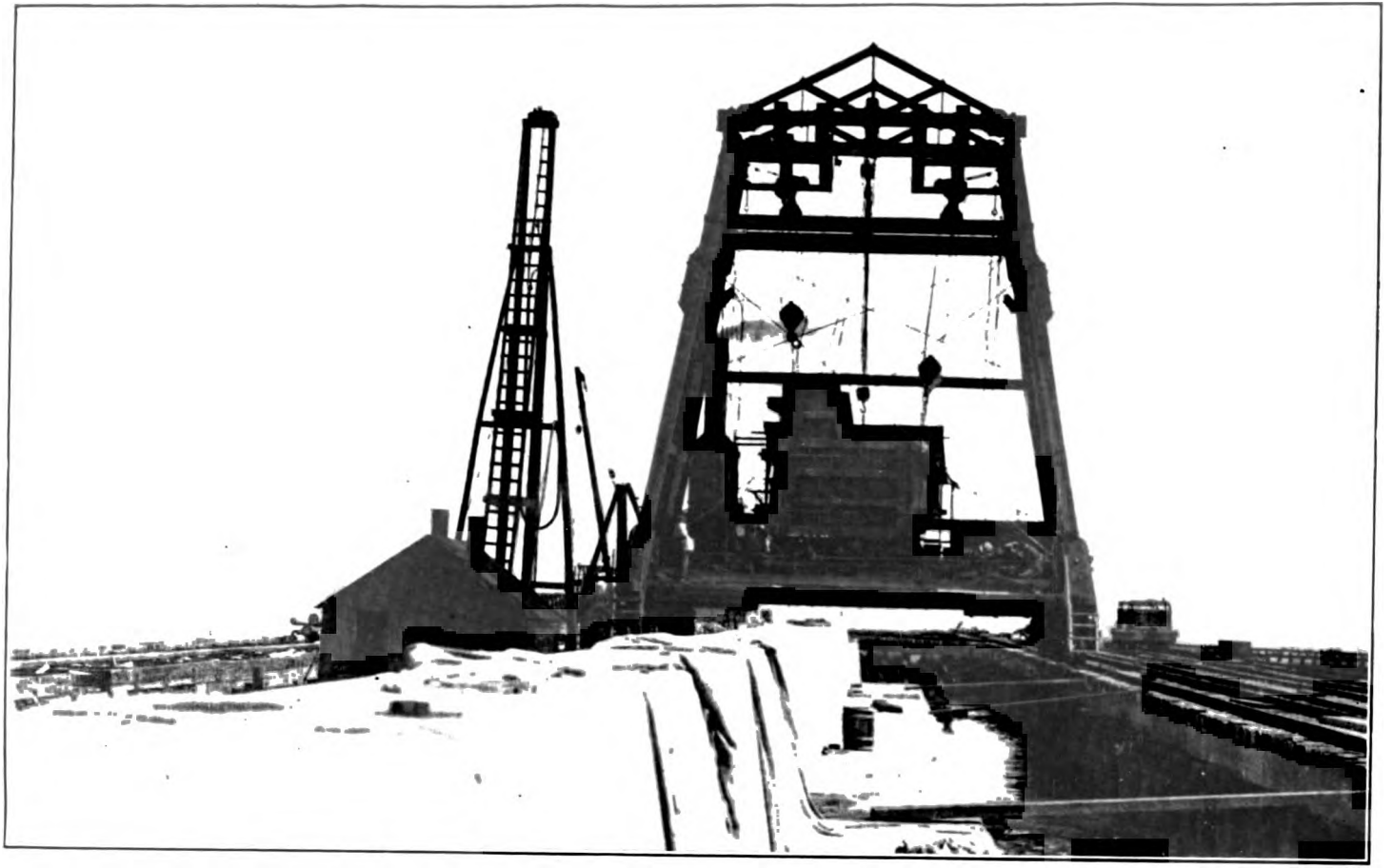

SETTING AN ASSEMBLED SUPERSTRUCTURE MOLD WITH THE SUBSTRUCTURE MOLD TRAVELER.

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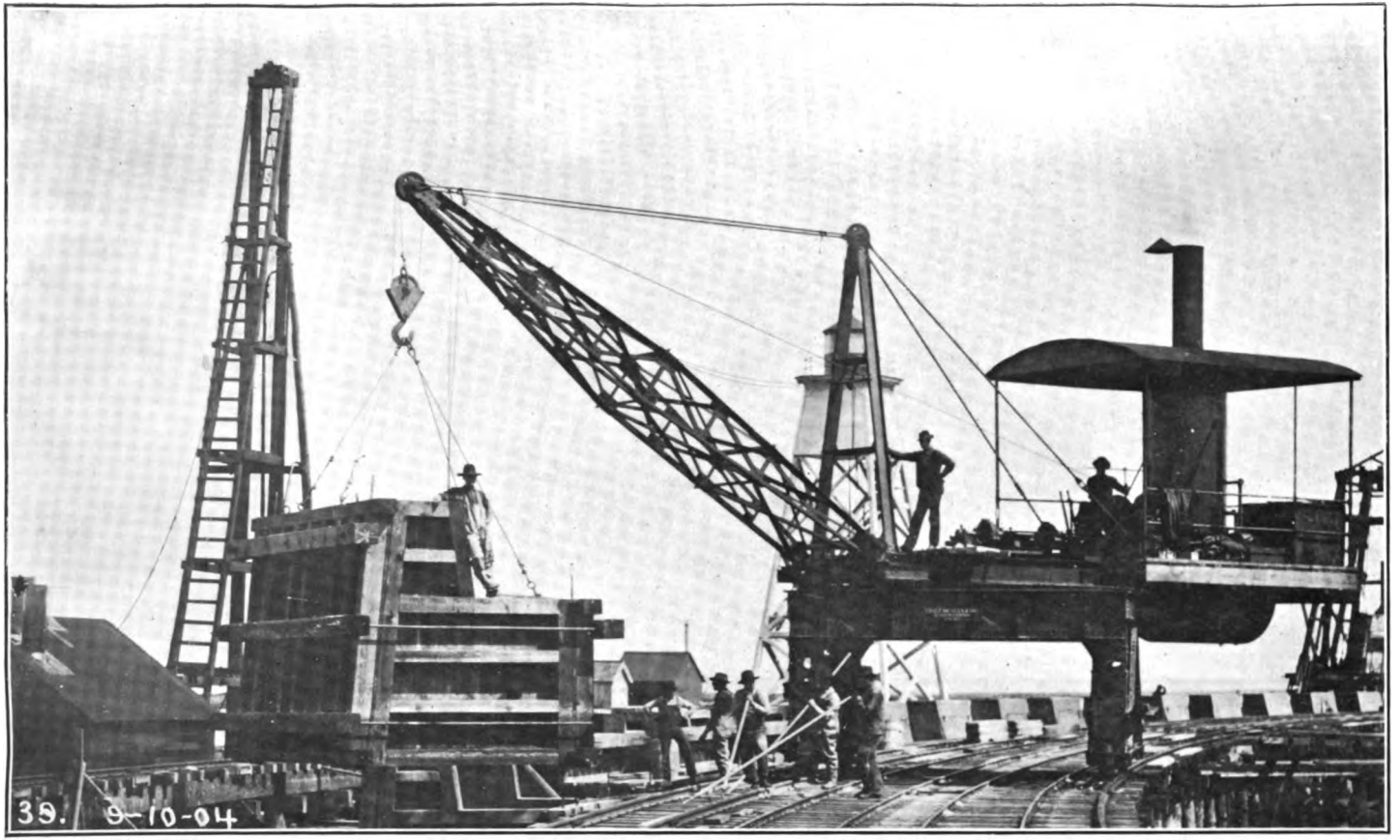

SETTING AN ASSEMBLED SUPERSTRUCTURE CONCRETE MOLD WITH A STEEL TRAVELING DERRICK.

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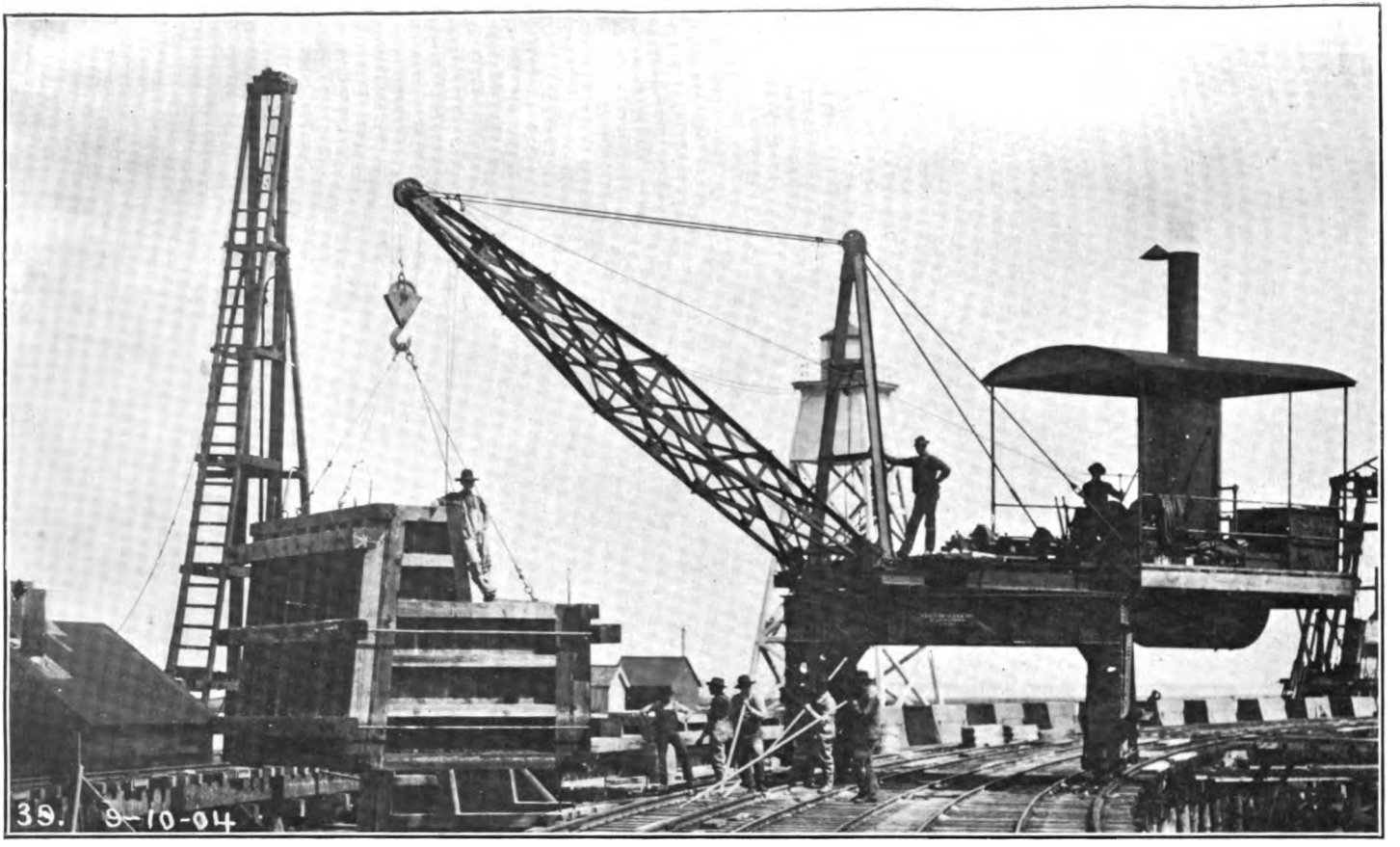

SETTING AN ASSEMBLED SUPERSTRUCTURE CONCRETE MOLD WITH A STEEL TRAVELING DERRICK.

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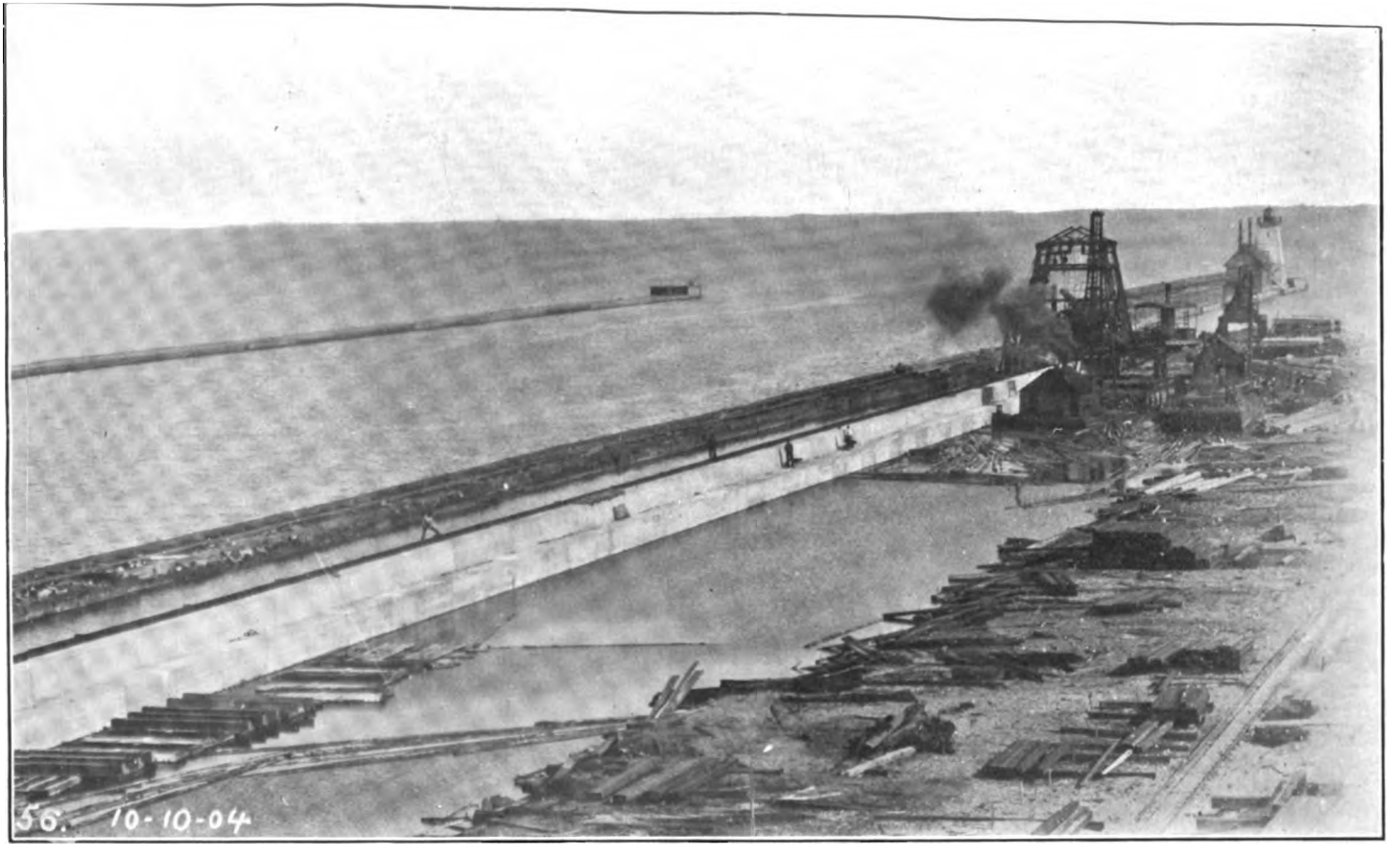

COMPLETED CONCRETE PIER NEAR LAKE SHORE.

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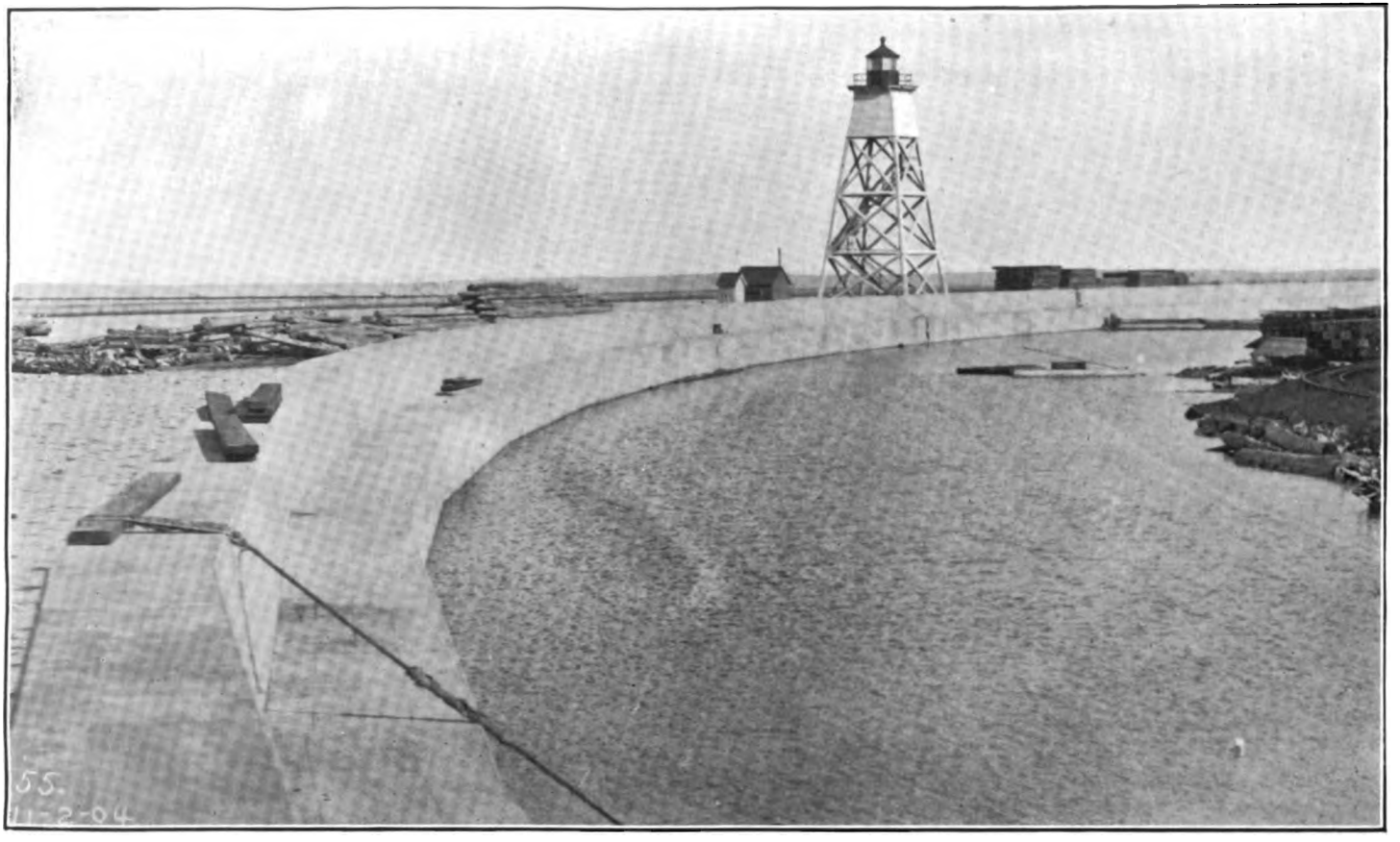

PORTION OF COMPLETED CONCRETE PIER, SHOWING CURVE.

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be performed in setting and removing molds, in no instance has any delay occurred due to fault in the design nor have the services of a submarine diver ever been required. It is to be regretted that the condition of the water at this locality, due to the sedimentation from the Nemadji River, prevents visual inspection of the subaqueous concrete. However, the surfaces of these subaqueous blocks, as examined with the bill of a pike pole, appear to be smooth and hard, and whenever a piece has happened to come away on a mold through adhering in the act of removal the concrete appears to be first class in every respect.

The specific gravity of the subaqueous concrete was determined as 2.3736, and weight per cubic foot 148.35 pounds.

The specific gravity of the superaqueous concrete was determined as 2.416, and weight per cubic foot as 151 pounds. Some tests were made on subaqueous concrete which had been deposited in the molds and then removed with long-handled shovels in the process of leveling the tops of subaqueous blocks to receive the superstructure molds.

This concrete was made into briquettes and broken after 7 and 28 days, 6 months, and 1 year, and shows even after this severe treatment 246 pounds, 261 pounds, 465 pounds, and 446 pounds tensile strength per square inch, respectively. The adhesion of the mortar was sufficient to break the pebbles in many instances. When it is remembered that these pebbles are from the hard igneous rocks of the north shore of Lake Superior some just measure of the integrity of this subaqueous concrete may be estimated. The horizontal 4 by 4 inch holes in the intermediate subaqueous blocks, which were used to enable the tie-rods of the intermediate blocks to be withdrawn, were filled with cement grout.

To carry out this operation in 18 feet of water a piece of 1-inch pipe about 26 feet in length, with a short piece of pipe about 1 foot long, connected at the lower end by a 90° elbow. Attached to the end of the short pipe was a rod about 2 feet in length. A muslin bag of slightly greater end area than the hole to be filled was placed over the rod and made secure over the end of the short pipe with a heavy rubber band. On the upper end of the long pipe was fixed a box funnel, so two men on the banquette of the pier could pour grout into the funnel. The grout under head pressure passed down through the vertical pipe and through the short arm which had been inserted into the hole to be filled. The pressure filled and expanded the bag which accommodated itself to the exact shape of the hole.

The short end was then quickly withdrawn by means of a rope attached to the 90° bend, and the rubber band acting, as the pipe was withdrawn, closed the mouth of the bag, leaving a plug of cement mortar 4 by 4 inches by 3 feet long in the end of each hole.

For a full understanding of the arrangement and purpose of these tie-rod holes, see Report of the Chief of Engineers for 1904, Appendix A A A 19, pages 3781 and 3782.

As winter weather approached noticeable openings were observed at the vertical joints of the superstructure blocks, increasing as the temperature became lower. Careful measurements were made of these openings, and their sum represented with astonishing exactness the correct contraction as deduced from the coefficient for change of volume due to thermal causes in concrete. At the present time the openings have all disappeared, and the blocks are again in close contact as built. This seems to emphasize the necessity of frequent vertical joints in long walls of concrete. It is assumed that in the subaqueous concrete, immersed in the water of Lake Superior, the thermal variation is so small that the volume is almost constant.

After the conclusion of the concrete work for the season of 1904, all of the pile trestles with their tracks were removed, and the materials conveniently stored for the lakeward extension of the concrete pier. A new roadway was located, graded, and track laid thereon from the concrete mixer out to the lake shore. The use of this track for the transportation of concrete overland will allow all the trestle materials on hand to be used in the lake for the further extension of the south pier and obviate the necessity of purchasing piles and timber for that part of the work. All of the substructure concrete molds used on section O–P have been enlarged to suit the lake cross-section Q–R, and the superstructure molds for that section have been built. The incline sand trestle used for supplying sand to the mixer has been extended to reach an ample supply of suitable sand. The stock pile of pebbles contains 12,000 cubic yards.

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In response to an invitation for proposals for dredging part of the trench for the concrete south pier, dated September 22, 1904, one bid of 50 cents per cubic yard for material measured in place in the trench was received on October 5 from the Lake Superior Contracting and Dredging Company. This price seemed excessive and was rejected. Owing to the approach of winter there was no time to make other arrangements and the preparation of the trench was abandoned until April 17, 1905, when a bid was received from the same dredging company for doing this work at 25 cents per cubic yard. The pile-protection dike shown on sheet 1, Appendix A A A 19, Report of the Chief of Engineers, United States Army, for 1904, was partly built, and the work of dredging commenced. On May 1, 2, 3, and 4 a storm of unusual violence prevailed, which resulted in the destruction of the outer portion of the pile dike, and necessitated the suspension of the dredging operations until the protection work could be replaced. After careful consideration of the risks incidental to exposed lake work at this locality it was determined to replace the outer end of the pile dike with cribs filled with sand. It is believed that the same cribs can be made available for protection on the north-pier construction by pumping the sand out, floating them to place, and refilling with sand. Timber was immediately purchased and the construction of four cribs commenced. Two of these cribs, Nos. 1 and 2, are 30 by 30 by 100 feet. Nos. 3 and 4 are 30 by 30 by 95 feet. They are constructed each with three sand-ballast pockets, 8 by 28 by 28 feet, for sinking, and for their remaining length are bottomless. A trench will be dredged on the crib location 3 feet below the lake bottom and the cribs being sunk to position in the trench by filling the ballast pockets with sand by means of the sand pump, the remaining length and depth of the cribs will then be filled in a like manner. All seams and joints in the cribs are closed with 1 by 4 inch battens. At this date cribs 1 and 2 have been completed and 3 and 4 are 50 per cent complete. The substitution of cribs for piles on the outer accessory work will give protection to the entire length of the pier beyond the shore line while under construction, as the cribs can be placed out beyond the pierhead location where the depth of water precluded the use of a pile dike. This should form a very effective protection during the progress of the work.

For the purpose of increasing the track yard in the vicinity of the mixing plant and at the same time accomplishing work which must be ultimately done, it was determined to refill the pier trench at this point. The work was successfully performed with the 8-inch centrifugal sand pump, at a cost of 7.6 cents per cubic yard.

The total refilling required in connection with the construction of these piers will exceed 300,000 yards, and it was deemed expedient and economical to build a sand pump for the performance of that work.

Accordingly, under authority from the Chief of Engineers, a pump scow 74 by 24 by 6 feet was constructed, and a 15-inch centrifugal sand pump, with all accessories, and a 150-horsepower boiler was purchased, after due advertisement. This machinery is now being installed. This pump will also be used for filling and pumping out the cribs, which is an additional use not contemplated at the time the authority for purchase was requested.

All work has been performed with United States plant and hired labor, and the plant is practically complete for the entire construction of the piers, with the exception of work requiring the use of a dipper dredge.

The testing of materials for concrete has been carried on at the laboratory during the year, and very much useful information has been obtained and systematically recorded. The tests on cement and other materials for concrete, which the existence of important concrete works in this district has made constantly necessary for the past ten years, has resulted in the accumulation of a very considerable amount of information on this subject, which it has not been practicable to publish in the annual reports, and has enabled this office to give information on cement and its kindred subjects in response to frequent inquiries from other United States engineer offices.

I have been very efficiently assisted in the conduct of the work throughout the year by Mr. M. W. Lewis, junior engineer; Mr. G. A. Taylor, junior engineer to January 10, 1905, and Mr. Charles Carlsch, junior engineer since March 13, 1905.

No accidents involving serious injury to employees have occurred, and no loss of property or violation of the laws of the United States, otherwise than those reported, have been observed.

Very respectfully,

CLARENCE COLEMAN, *Assistant Engineer.*

Maj. CHAS. L. POTTER, *Corps of Engineers.*

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I I 4.

IMPROVEMENT OF HARBOR AT PORTWING, WISCONSIN.

For a detailed description of this harbor reference is made to the following sources:

Current summary, giving approved project, etc.; House Document No. 114, Fifty-sixth Congress, first session, printed in Appendix K K, Annual Report of the Chief of Engineers for 1900, pages 3630 to 3636, containing reports on a preliminary examination, a survey, project for improvement, estimate of cost, and a complete map.

Bulletin No. 15, Survey of Northern and Northwestern Lakes, page 72. Also supplement to same, No. 1, page 5.

A small map of the harbor is printed with the Report of the Chief of Engineers for 1903.

By act of Congress approved June 13, 1902, the following provision was made for the improvement of this harbor:

Improving the harbor of Port Wing, Wisconsin, in accordance with the report submitted in House Document Numbered One hundred and fourteen, Fifty-sixth Congress, first session, for a harbor of refuge, twenty-five thousand dollars: *Provided*, That no part of said sum shall be expended until the title of the land necessary for the establishment of said harbor, according to said report, shall have been properly and legally conveyed by or through the authorities of Port Wing to the United States Government.

In 1902 the citizens of Portwing took steps which resulted in the conveyance to the United States of a tract of land containing about 7 acres which was needed for the purpose of harbor improvement. Its boundaries are shown on the map accompanying the Chief of Engineers' Report for 1903.

Upon the acquirement by the United States of the necessary land, and after due advertisement, contract was entered into with Hugo & Tims, dated March 28, 1903, and work under the contract began June 1, 1903. During the season there were dredged 24,333 yards, giving a channel through the entrance 14 feet at low-water datum for a narrow width, and vessels drawing 14 feet used the channel without difficulty during the prevailing stage of water. The east pier, 800 feet long, was built in accordance with the project, and a revetment or wing wall at the inner end of the pier, 45 feet long.

The pier is built of two rows of piles tied together with steel rods and filled with slabs and rock. Riprap of sandstone was placed against the rear of the pier reaching up to near the water surface, but no riprap was placed in the channel.

Further dredging was done by the Government in 1904 between the dates of August 9 and October 11, under contract, by the Northern Dredge Company, with a clam-shell excavator. Amount of material removed was 15,041 yards, at the price of 17 cents per yard. This gave a channel through the entrance 100 feet wide with a depth throughout of not less than 15 feet at low-water datum, the easterly edge of the channel being 15 feet from the pier. This dredging reached a distance of 100 feet into the river south of the south end of the entrance pier, and connected with the private channel which extends farther up along the lumber wharf.

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Of the proposed turning slip at inner end of the pier a small portion 30 feet wide and extending 50 feet eastward from the line of the west face of the pier has been dredged.

The latest survey of the entrance shows a sand bar advancing into the channel from the west at a point 400 feet in from the north end of the east pier, which narrows the 14-foot depth of water to a width of 70 feet at that point. The new west pier when built will stop this encroachment of sand.

The least depth of water through the entrance, on a line 50 feet from the east pier, is 14½ feet at low-water datum, and 15½ feet at the present stage.

A contract has been entered into with Whitney Brothers Company for building 601 linear feet of pier on the west side of the entrance, at a probable cost of $14,100. (This contract has not yet been approved.) The type of construction is that of the east pier, with a few modifications in minor details suggested by the experience in building the east pier.

The lumber firm of Moore, Keppel & Co. shut down their sawmill at Port Wing in June, 1905, having manufactured the whole of their supply of timber. There is more timber which is or might be tributary to Port Wing, but there are no arrangements for operating the sawmill. This shut down will be a severe blow to this town, and a check to the business of the harbor.

The funds asked for are to be used for maintaining the present work after completion.

Money statement.

July 1, 1904, balance unexpended		$3,523.93
Amount appropriated by river and harbor act approved March 3, 1905		19,992.00
		23,515.93
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$3,000.00	
For maintenance of improvement	623.26	
		3,623.26
July 1, 1905, balance unexpended		19,892.67
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905		3,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

APPROPRIATIONS.

June 13, 1902	$25,000
March 3, 1905	19,992
Total	44,992

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COMMERCIAL STATISTICS.

Arrivals and clearances of vessels at Port Wing, Wis., for calendar year 1904.

Vessels.	Arrived.	Cleared.	Total.	Tonnage.
Steam	145	145	290	72,490
Tow	7	7	14	8,666
Tugs	81	81	162	4,212
Total	233	233	466	[a] 85,368

[a] Partly estimated.

Passengers arriving, 510; departing, 510; total, 1,020.

Freight received and shipped.

	Tons.[a]	Valuation.
Brownstone (195,000 cubic feet)	15,600	$78,000
General merchandise	1,211	199,815
Shingles (2,000 M)	200	5,000
Lumber (13,070 M feet)	19,605	199,318
Cedar poles and piles (60,000)	7,500	84,000
Cedar ties and posts (5,000)	278	2,000
Total	44,394	568,133

[a] Tons of 2,000 pounds.

The scows used to transport stone and cedar and the numerous tugs and other boats in the coasting trade, which used the port as a harbor of refuge, are not included in the above figures.

I I 5.

IMPROVEMENT OF HARBOR AT ASHLAND, WISCONSIN.

For a detailed description of this harbor, see recent Annual Reports of the Chief of Engineers, United States Army, and Bulletin No. 15, page 40, of the United States Lake Survey.

The work of strengthening the main breakwater by revetment of riprap, which was commenced in 1903, has covered a distance of 1,766 feet, or about one-fourth of its entire length. A cross section of this work is shown herewith.

The appropriation of March 3, 1905, of $60,000 " for maintenance " will be devoted entirely to this important work of reenforcing the main breakwater, so as to form a permanent rubble mound, with the old frail structure of piles and slabs for a hearting.

A contract (which has not yet been approved) has been entered into with George Wieland for placing riprap in this revetment, for 79 cents per ton of 2,000 pounds, a very low price. At this price the available funds will revet about 3,516 feet, making, with what has already been done, a total of 5,282 feet, or 72 per cent of the entire length. This contract is to be finished by December 1, 1906.

After this contract is completed there will remain a length of probably 2,081 feet to be revetted. This remaining portion will cost more per linear foot, on account of deeper water, a wider section, and

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a probable higher cost of rock per ton, making it possibly $25 per linear foot, or $52,025. Adding to this 15 per cent for administration, a sum of $5,000 for filling out possible deficiencies from settlement in the preceding work, gives $64,828 for an approximate estimate of the additional sum needed to complete this revetment.

The completion of this revetment is deemed of more importance at the present time than further extensions of the breakwater.

The harbor-front channel, as extended 900 feet in 1903, now reaches to 100 feet west of the prolonged west line of Beaser avenue. The extension is 100 feet wide, with a least depth of 19 feet, as shown by a survey made September 16, 1903. The entire dredged channel is about 4,360 feet long, with a least depth of 18 feet at low-water datum for a width of 90 to 140 feet. The channel is not marked in any way at present. It is straight, and at the northerly end the east line of the channel is 500 feet off the outer end of the Commercial dock, while at the south end the east line passes 60 feet outside the Barker & Stewart lumber docks, and terminates off the fourth one of this set of lumber docks, counting from the north. The channel can be used by the largest vessels at the usual stages of water.

Although some shoaling has occurred since first dredged, it does not seriously interfere with navigation, and it is not thought advisable to expend any of the present appropriation in its maintenance.

The appropriation recommended will be applied as follows: For maintenance, $75,000, of which $65,000 is for completing revetment of the main breakwater, and $10,000 for removing shoals; and for improvement, $15,000 applied to channel extension.

Money statement.

July 1, 1904, balance unexpended	$9,853.76
Amount appropriated by river and harbor act approved March 3, 1905	60,000.00
	69,853.76
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	8,897.98
July 1, 1905, balance unexpended	60,955.78
Amount (estimated) required for completion of existing project	326,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:	
For works of improvement	$15,000.00
For maintenance of improvement	75,000.00
	90,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

ABSTRACT OF APPROPRIATIONS FOR IMPROVING HARBOR AT ASHLAND, WIS.

August 5, 1886	$22,500	March 3, 1899	$35,000
August 11, 1888	60,000	June 13, 1902	40,000
September 19, 1890	60,000	March 3, 1905	60,000
July 13, 1892	45,000		
August 18, 1894	25,000	Total	374,500
June 3, 1896	27,000		

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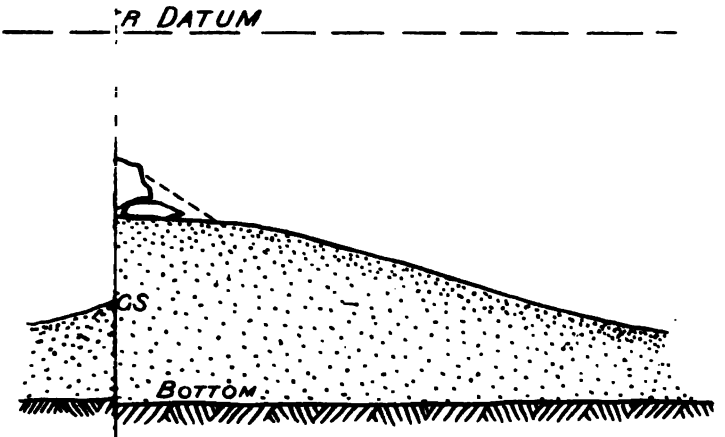

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COMMERCIAL STATISTICS.

Arrivals and clearances of vessels at Chequamegon Bay (Ashland and Washburn) for the calendar year 1904.

	Number.	Net registered tonnage.
Arrivals	943	1,351,872
Clearances	944	1,352,306
Total	1,887	2,704,178

Receipts and shipments of principal articles during calendar year 1904.

	Tons.
Receipts:	
Coal, hard and soft	437,089
Miscellaneous merchandise	1,500
Iron pyrites	2,861
Total	441,450
Shipments:	
Iron ore	2,563,008
Pig iron	17,864
Lumber (175,337 M feet)	263,006
Grain (5,895,000 bushels)	150,000
Total	2,993,878
Total receipts and shipments	3,435,328
Total valuation	$18,725,768

Logs, 200,000 M feet B. M.

NOTE.—There was in addition a local business between Ashland and Washburn and Bayfield of 1,679 trips of ferryboats, carrying 28,545 passengers and 118 tons of freight, and a number of tugs towing stone, etc.

I I 6.

IMPROVEMENT OF HARBOR AT ONTONAGON, MICHIGAN.

For further details see previous Annual Reports of the Chief of Engineers, United States Army, particularly the one for 1896.

A survey of the harbor and of the river up to a distance of about five-eighths of a mile above the bridge was made in June, 1903, under directions of this office, by H. H. Wadsworth, assistant engineer. A reduced copy of the resulting map accompanies the report for 1903.

Private dredging was done during June and July, 1904, for the Ontonagon Lumber and Cedar Company, along the west side of the river and in front of the new docks of the company, from the southerly end of the west entrance pier to a point about 850 feet above the highway bridge. This company had built a new sawmill and could not wait for the Government to dredge a channel, as there were no funds available at that time. The work consisted of two cuts aggregating 60 feet in width, to a reported depth of 17 feet, amounting to 27,689 yards, at a cost of $4,709.

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Early in the spring of 1905 several bad shoals were found in the entrance channel. There was a bar in the lake directly in front of the entrance and about 200 feet out from the pier light, which had a least depth of only 5.4 feet at low water, but was of small area, and vessels drawing 10 feet could pass to either side of it. Another shoal was found between the piers and about 1,000 feet in from the lake, with a least depth of 7.3 feet.

There was also considerable shoaling elsewhere, and the private dredging done in 1904 on the west side of the inner harbor was badly filled up.

This unusual and remarkable shoaling is believed to have been caused by masses of ice obstructing the channel while a stiff current of water came down the river.

A survey of the entrance was made April 26–27, 1905, and copies of the map were furnished to parties interested in using the channel, by the aid of which vessels drawing 10 feet could enter and leave the harbor.

A dredge which was coming from Houghton to Duluth was engaged by telegraph to stop and do what dredging was possible with the $3,000 on hand. The dredge, however, could not enter on account of ice in the lake, and so the work was not done.

Then an allotment of $5,000 was requested from the Chief of Engineers, United States Army, and allowed May 13, 1905, from the emergency appropriation for rivers and harbors (act March 3, 1905), and added to the $3,000 funds on hand, and on May 15 the Zenith Dredging Company was engaged to remove 30,000 to 40,000 yards at 20 cents, which was the lowest price offered by two different firms.

Under this agreement work was commenced May 22, 1905, prosecuted twenty-four hours a day, and was completed June 15 to the extent of the available funds. The amount of material removed by the Government was 36,310 yards, at a contract cost of $7,262. This was supplemented by the county of Ontonagon, which added about $500 worth of dredging on the west side of the inner harbor, and by the Ontonagon Lumber and Cedar Company, which did a less amount of dredging immediately adjoining their wharf.

A survey of the channels was afterwards made and mapped.

The aboved-mentioned dredging gave a channel through the bar in the lake 120 feet wide and 15 feet deep at low water, a channel between the entrance piers 14 feet deep, for a width of at least 60 feet, the center line of which lies 100 feet from the west pier, and a channel along the west side of the inner harbor to the lumber dock 12 feet deep and about 75 feet wide.

There is an available depth of 11 feet to the docks on the east side of the inner harbor remaining of the Government dredging done in 1903.

The channels dredged as above described, while permitting navigation, are too narrow for the needs of the commerce of this port. The east pier is generally in good condition. The west pier is badly decayed near the outer end. The appropriation of $15,000 recommended will be applied to further dredging and maintenance of the piers.

A railroad bridge was built across the Ontonagon River in the fall of 1904 and winter of 1904–5 by the Chicago, Milwaukee and St. Paul Railroad Company, under authority of the legislature of the

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State of Michigan, and in accordance with the plans approved by the Secretary of War and under the supervision of this office.

This bridge is located about 2,200 feet above the highway bridge. It is a wooden bridge, having three main spans with 100-foot clear openings each and 9 feet in clear height above low-water datum. There is no draw span, as the navigation in that locality does not require one at present. The permit for the construction, however, provides that the company shall place a suitable draw in the bridge whenever required by the Secretary of War.

Money statement.

July 1, 1904, balance unexpended	$335.36
Amount appropriated by river and harbor act approved March 3, 1905	3,000.00
Amount allotted from appropriation for maintenance of river and harbor improvements, act of March 3, 1905	5,000.00
	8,335.36
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	7,971.53
July 1, 1905, balance unexpended	363.83
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	15,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

ABSTRACT OF APPROPRIATIONS FOR IMPROVING HARBOR AT ONTONAGON, MICH.

March 2, 1867	$97,600	September 19, 1890	$10,000
July 7, 1870	10,000	July 13, 1892	20,000
June 23, 1874	23,000	August 7, 1894	7,000
March 3, 1875	25,000	June 3, 1896	10,000
August 14, 1876	15,000	Received on account of damage to piers	28
June 18, 1878	15,000	June 13, 1902	5,000
March 3, 1879	17,000	March 3, 1905	3,000
June 14, 1880	15,000	Allotment from emergencies in river and harbor works, act March 3, 1905	5,000
March 3, 1881	20,000		
August 2, 1882	20,000		
July 5, 1884	15,000		
August 5, 1886	13,000		
August 11, 1888	12,500	Total	358,128

COMMERCIAL STATISTICS.

Arrivals and clearances of vessels at Ontonagon, Mich., for calendar year 1904.

Class.	Arrived.	Cleared.	Total.	Net registered tonnage.
Steam	130	130	260	91,000
Tow	9	9	18	12,600
Total	139	139	278	103,600

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Principal articles received and shipped, 1904.

	Tons.
Receipts:	
General merchandise	4,000
Fish	400
Total	4,400
Shipments:	
General merchandise	500
Lumber (8,000,000 feet)	12,000
Total	12,500
Receipts and shipments	16,900
Increase in freight	8,910

Logs received, 1,000,000 feet B. M.

Freight received and shipped.

[Tons of 2,000 pounds.]

Item.		Quantity.	Valuation.
General merchandise	tons	4,500	$742,500
Fish	do	400	80,000
Lumber	M feet	8,000	122,000
Logs	do	1,000	12,000
Total valuation			906,500
Increase in valuation			882,690

I I 7.

IMPROVEMENT AND OPERATING AND CARE OF WATERWAY FROM KEWEENAW BAY TO LAKE SUPERIOR, MICHIGAN.

For the history of this waterway and its purchase by the United States see Report of the Chief of Engineers for 1892, Appendix I I, page 2158. For the work of improvement by the United States see subsequent annual reports. A complete detailed description of this waterway is also given in Bulletin No. 15, published by the survey of Northern and Northwestern lakes, April 15, 1905, pages 65 to 70. See also the new chart, in colors, issued March 15, 1905, by the survey of Northern and Northwestern lakes.

The approved project for improvement is not fully completed, although nearly so, and the river and harbor act of March 3, 1905, appropriated $45,000 for "continuing improvement."

After due advertisement, bids were opened June 27, 1905, and the contract awarded to James Pryor, the lowest bidder, subject to the approval of the Chief of Engineers, for dredging about 117,000 yards in Portage River and at near the head of Portage Lake. This will make a channel 20 feet deep and 120 feet wide throughout.

The large commerce carried through the Portage Lake canals is evidence of the importance of this waterway and of the benefits derived from its improvement.

The needs of further improvements to this waterway have begun to receive consideration.

In my special report to you under date of December 29, 1903, was set forth the need of a harbor of refuge at the lower end of this water-

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way, just inside the mouth of Portage River, similar to the harbor of refuge near the upper end, known as Lily Pond. Plans for such a harbor accompanied the report, and an estimate of its cost, which was $150,000. It is hoped that this matter will soon be given consideration by Congress.

Another possible improvement that would be of value is to straighten the channel of Portage River by cutting off Princess Point, with its sharp bend, a bend that is causing considerable inconvenience to the larger class of vessels, especially passenger boats, that now use this waterway. This matter will be considered further and be made the subject of a special report.

There is now a minimum depth of 20 feet at low-water datum throughout this waterway, and generally a width of 120 feet or more having this depth. There are two localities where the width is deficient, one being at the upper end of Portage River, from range light No. 15 to the open lake. The other is on the Rouleau Range, in the upper portion of Portage Lake, through the shoals between High Point and Rouleau Point. Both of these localities will be widened by the dredging provided for this season.

OPERATING AND CARE.

Location.—The Portage Lake ship canals constitute the waterway across Keweenaw Point, in the State of Michigan, from Keweenaw Bay to Lake Superior, there being about 25 miles of water route, consisting of 5½ miles of Portage River, with its four cuts, 17 miles of Portage Lake, and 2¼ miles in the upper canal from the head of Portage Lake to Lake Superior.

Under authority of the river and harbor act of September 19, 1890, the Secretary of War allotted $15,000 for operating and care of canals and other works of navigation, to be applied to Portage Lake and Lake Superior canals, Michigan, for the fiscal year ending June 30, 1905.

The approved project for the expenditure of this allotment is to maintain the depth and width obtained by the work of improvement; to keep a record of the vessels and their tonnage using the canals; to exercise the necessary care in enforcing regulations for the use of the canals; to make frequent surveys to determine changes and to check up work done in dredging; to guard against encroachments on the legally established harbor lines, and to perform other work incident to the operation and care of the canals. The amount allotted has been expended in carrying out the above program of duties.

Dredging was done for removing shoals, under agreement with James Pryor, dated August 5, 1904, to the amount of 20,356 yards of material and a cost of $4,216.33. The work done was at two points, one opposite Princess Point and one opposite and just above Cut 5.

The portions thus cleared up were afterwards surveyed and mapped.

Additional topographical and hydrographical surveys were made at certain localities along Portage River and along the lake shore near Portage Entry, Jacobsville, and Red Rock to supply deficiencies in the recent general survey of the waterway, and these results were embodied in the new and complete chart of Portage Lake and River, in

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colors, issued by the United States Lake Survey, Detroit, March 15, 1905. This chart should be consulted for much detailed information that can not be described in this report.

Surveys were made for the United States Light-House Establishment for the location of new positions for lights 9, 10, and 12, and points were located for placing buoys at the head of Portage Lake near Mill Point and for marking a shoal off the Portage Coal and Dock Company's wharf, Hancock, where vessels had run aground.

A record of the water level has been continued three times a day at three points—at Houghton, at the watchman's house at the upper canal, and at the watchman's house on Portage River. A new gauge was established at Houghton on the Houghton County Electric Light Company's dock, where the water is kept free from ice by the condensed water from the steam engine.

Repair work was done during the fiscal year as follows: Heavy steel plates were placed on the end of the pier at Portage Entry, completing repairs where the pier was damaged October 22, 1903, by being struck by a schooner.

Thirteen breaks were made in revetments by vessels. Six of these breaks were small, and were repaired by the Government by hired labor and purchase of materials in open market. Three other breaks were repaired by McCurdy Brothers, the lowest bidders, after public notice, at a cost of $410. Four breaks caused by the schooner *Ashland* have been repaired by McCurdy Brothers, at a cost of $410, and the bill for same forwarded to the owner of the vessel for payment, in accordance with his agreement to pay for same.

The severe storm of December 27–30, 1904, damaged the breakwaters at the Upper Entrance, tearing off plank and steel plates from the sloping face for a distance of about 60 feet and washing out 100 cords or more of rock filling. Some of the underwater repairs was done last winter, working through the ice, by hired labor and open-market purchase of material, at a cost of $205. The remainder was done by contract, after public notice, by Whitney Brothers Company in June, 1905, at a cost of $1,183.

The 6-inch sloping-face plank are being reenforced with lag screws ⅜ by 14 inches in size, two to each plank, which are about 16 feet long. Two thousand of these screws were placed in 1903, and none of the plank thus secured have been loosened. The remaining sloping plank of the main sections of the breakwater are being treated in the same way, and 4,000 screws have been placed this season to date, at a cost of $390, and 1,600 more screws are to be placed.

The draw span of the Houghton-Hancock bridge was wrecked April 15, 1905, by the steamer *Northern Wave*, which struck the bridge while it was being swung and threw the span over on its side, entirely blocking both channels. I visited the site at once and brought about an arrangement by which the two railroad companies, which operate the bridge, entered into contract, April 18, with the Wisconsin Bridge and Iron Company to remove the wreck, and work began immediately. The south opening was cleared and open to navigation April 25. The remainder of the wrecked bridge was removed by May 25, and a locomotive tender and flat car loaded with rails, which had fallen through a temporary ponton bridge on April 17, were removed from the north channel by June 8.

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A new draw span is to be built, of larger size than the old one, by the Copper Range and Mineral Range railroad companies and Houghton County, in accordance with plans which were approved by the Secretary of War January 7, 1901, and a contract for its construction was awarded June 13, 1905, to the Wisconsin Bridge and Iron Company. The plans provide for two draw openings, the north one 108 feet and the south one 118 feet in clear width.

The bridge is expected to cost about $92,400, and the bridge company guarantees to have it in working order by March 1, 1906.

Two watchmen have been employed, one at the upper canal and one at Portage River. Each has kept a record of all passing vessels and rafts, reported damages to piers and revetments from collisions, violations of rules and regulations, and read a water gauge. The watchman at upper canal also kept a record of three wave dynamometers located on the breakwater piers.

The gasoline launch *Arc*, 16 feet long and 3 horsepower, which had been in use at Duluth Harbor since 1897, was transferred to Houghton in September, 1904, for use by the Portage River watchman in patrolling the river.

Death of Mr. Marr, superintendent.—This district has lost by death Mr. George A. Marr, who passed away March 24, 1905, at Chicago while returning from a trip to Mexico, which he had taken in hopes of regaining his health. His illness dates back to about last Christmas, but was not considered serious by his friends until after he reached Mexico. He was in a hospital in the City of Mexico about a week, and the attending physician diagnosed carcinoma of the liver. His son-in-law, Dr. F. W. Smith, of Aylmer, Ontario, met him in Chicago and took him to a hospital, where he died in about five hours. His age was 68.

Mr. Marr has been connected with this office since October, 1892, as assistant engineer and superintendent of the Portage Lake canals, in local charge at Houghton, Mich., and filled this position in a creditable manner, as, indeed, may be said of his entire long service of forty-four years on Government engineering work.

Since the death of Mr. Marr the local charge of the Portage Lake canals has been in the hands of George H. Banks, junior engineer, overseer. Mr. Banks had assisted Mr. Marr for a number of years in the office and field, thus becoming thoroughly familiar with the duties of the position.

Money statements.

IMPROVEMENT.

Amount appropriated by river and harbor act approved March 3, 1905	$45,000.00
June 30, 1905, amount expended during fiscal year for works of improvement	367.27
July 1, 1905, balance unexpended	44,632.73

OPERATING AND CARE OF CANALS.

July 1, 1904, amount allotted for fiscal year 1905	$15,000.00
June 30, 1905, amount expended during fiscal year 1905	[a]14,820.00
July 1, 1905, amount allotted for fiscal year 1906	11,500.00

[a] The sum of $180 outstanding liability for services of G. A. Marr, in March, 1905, which will be paid in July, 1905, thus covering the entire allotment.

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APPROPRIATIONS.

September 19, 1890:	
For the purchase of Portage canals	$350,000.00
For maintenance to June 30, 1892	10,000.00
For harbor lines, Portage Lake	5,128.70
Total	365,128.70

The above amounts were expended for the purposes for which appropriated.

ABSTRACT OF APPROPRIATIONS FOR IMPROVING WATERWAY FROM KEWEENAW BAY TO LAKE SUPERIOR, MICHIGAN.

July 13, 1892	$50,000.00	March 3, 1901	$145,000.00
August 18, 1894	130,000.00	June 28, 1902	10,000.00
June 3, 1896	50,000.00	March 3, 1905	45,000.00
June 4, 1897	350,000.00	Miscellaneous	237.68
July 1, 1898	450,000.00		
June 6, 1900	110,000.00	Total	1,340,237.68

The following statement shows the manner in which the appropriations have been expended. The amount expended under the different classes of work includes the cost of examinations, soundings, superintendence, buoying, and contingencies.

Dredging	$504,803.40
Pier work, revetment, etc	781,395.55
Purchase of land	9,406.00
Total	1,295,604.95

Allotments for operating and care of Portage Lake and Lake Superior canals, Michigan, from the permanent indefinite appropriation of act of July 5, 1884, for operating and care of canals, etc.

July 1, 1892	$31,028	July 1, 1900	$8,300
July 1, 1893	11,647	July 1, 1901	8,500
July 1, 1894	8,000	July 1, 1902	9,000
July 1, 1895	11,500	July 1, 1903	15,500
July 1, 1896	8,300	July 1, 1904	15,000
July 1, 1897	8,300	July 1, 1905	11,500
July 1, 1898	8,300		
July 1, 1899	8,300	Total	163,175

Previous to the 1902 allotment all the amounts were expended in maintaining the canals, except $117.36 of the 1892 allotment, which amount reverted to the Treasury. The $11,500 allotted July 1, 1905, will be expended during the fiscal year ending June 30, 1906.

COMMERCIAL STATISTICS.

Statistics of vessels passing through the canals during the calendar year 1904.

	Bound up.		Bound down.	
	Number.	Net tonnage.	Number.	Net tonnage.
Steam	1,217	1,162,424	842	488,482
Tow	442	326,053	248	174,102
Total	1,659	1,488,477	1,090	662,584

Total number of vessels up an down	2,749
Total net tonnage	2,151,061

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Openings and closings of navigation in Portage Lake ship canals, Michigan, while in charge of the United States, 1891 to 1904, inclusive.

Date of opening.	Steamer.	Date of closing.	Steamer.
April 26, 1892	Nipigon.	November 30, 1891	A. L. Hopkins.
May 9, 1893	Jos. L. Hurd.	November 30, 1892	S. F. Hodge.
April 22, 1894	Japan.	November 29, 1893	J. H. Shrigley.
April 25, 1895	Annie R. Hennes.	November 30, 1894	Jay Gould.
April 24, 1896	City of Duluth.	December 2, 1895	Matoa.
April 23, 1897	Peerless.	November 26, 1896	Cumberland.
April 17, 1898	Iroquois.	December 2, 1897	Japan.
May 1, 1899	R. G. Stewart.	December 4, 1898	Martin Swain (tug).
April 19, 1900	Bon Voyage.	December 15, 1899	Cora A. Sheldon, with whaleback No. 137.
April 23, 1901	Mabel Bradshaw.		
April 4, 1902	Bon Ami.	December 8, 1900	Cuba.
April 15, 1903	W. H. Gratwick.	December 8, 1901	Clyde, with Amboy.
May, 1904		December 13, 1902	Grover.
		December 9, 1903	Hutchinson.
		December, 1904	

Statistics of tugs passing through the canals during the calendar year 1904.

		Bound up.	Bound down.
Trips	number	471	468
Net registered tonnage		17,913	17,061
Vessels	number	23	15
Scows	do	266	296
Rafts	do	22	47
Booms	do	63	89
Logs	M feet	2,475	1,590
Lumber	do	1,693	20
Timber	do	10,492	740
Cord wood	cords	1,216	----------
Building stone	tons	13,878	----------
Coal	do	30	233
Manufactured iron	do	18	----------
Machinery	do	----------	150
Railroad ties	number	4,300	----------
Grain	bushels	6,040	2,310
Miscellaneous merchandise	tons	76	132
Oil	barrels	----------	5

Statement of freight and passengers carried through the Portage Lake and Lake Superior canals, 1904.

Bound up.	Tons.	Bound down.	Tons.
Coal:		Copper	66,008
Hard	98,144	Grain	23,741
Soft	1,073,086	Wheat	22,122
Manufactured iron	83,736	Flour	39,982
Salt	18,634	Oil	524
Copper	18,777	Iron ore	104,581
Limestone	50,651	Pig iron	7,520
Oil	2,630	Lumber	415,965
Building stone	1,106	Flaxseed	4,351
Lumber	18,040	Stamp sand	28,450
Sand	3,280	Machinery	150
Miscellaneous merchandise	116,530	Coal, soft	32,745
Cement	2,200	Miscellaneous merchandise	9,519
Machinery	80	Lath and shingles	7,546
		Railroad ties	2,158
Total by vessels	1,436,794		
Total down by vessels	765,807	Total	765,807
Total by tugs	93,821		
Total through canals	2,295,922		
Local (estimated)	100,000		
Grand total	2,395,922		

Passengers up	13,535
Passengers down	12,702
Total passengers up and down	26,237

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Statistics of vessels passing through the upper canal (Portage Lake ship canals) for calendar year 1904.

	Steam vessels.		Tow vessels.	
	Number.	Net tonnage.	Number.	Net tonnage.
Bound up	1,007	1,098,534	402	273,816
Bound down	721	392,176	298	121,865

Total vessels, 2,428; total net tonnage, 1,794,391.

Table showing estimated value of freight passing through Portage Lake ship canals for the calendar year 1904.

[Tons of 2,000 pounds.]

	Quantity.	Unit price.	Valuation.
Coal:			
Hard ..... tons	98,194	$6.25	$613,713
Soft ..... do	1,105,994	3.65	4,036,878
Flour ..... barrels	399,317	5.50	2,196,244
Flax ..... bushels	155,410	1.17	181,830
Wheat ..... do	737,394	1.04	766,890
Other grains ..... do	957,991	.50	478,995
Manufactured iron ..... tons	33,754	65.00	2,194,010
Pig iron ..... do	7,520	14.25	107,160
Iron ore ..... do	104,581	2.30	240,536
Copper ..... do	84,785	265.00	22,468,025
Building stone ..... do	14,984	5.00	74,920
Limestone ..... do	50,651	1.50	75,976
Oils ..... barrels	15,775	6.75	106,481
Salt ..... do	126,331	.70	88,432
Sand ..... cubic yards	21,153	.50	10,576
Lumber ..... M feet	270,016	15.25	4,117,744
Logs ..... do	10,064	12.00	120,768
General merchandise ..... tons	126,257	165.00	20,832,405
Cement ..... barrels	11,000	1.40	15,400
Laths and shingles ..... M	66,298	2.50	165,745
Machinery ..... tons	390	300.00	99,000
Railroad ties ..... number	43,050	.40	17,220
Total valuation			59,008,949

In the above table there is given a part of the local and the regular through business both ways through these canals. There is a large local business from one part of the Portage Lake to another and over in Torch Lake done by tugs with scows, booms, etc., transporting lumber, cord wood, hay, charcoal, etc., and also tows of rafts of logs and timber, amounting in value to over $1,000,000. There is also considerable traffic by small steamers running between different points around Portage Lake that do not make any reports unless they pass through the Portage River or the upper canal.

TRANSPORTATION LINES.

In regard to this report, usually given, there does not seem to be any particular reason to specify any lines of steamers and vessels, as all lines that now navigate on Lake Superior are liable to use these canals frequently, and the conditions of the channels is now such as to permit the use of this waterway by any vessel that can pass through the "Soo" River.

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Summary of expenditures made from appropriation for operating and care of canals and other works of navigation (indefinite), act of July 5, 1884, applied to Portage Lake and Lake Superior canals, Michigan, during fiscal year 1905.

Date.	Office expense.	Field service.	Pier and revetment repairs.	Miscellaneous.	Dredging.	Total.
1904.						
July	$200.00	$410.67	$98.87	$15.00		$724.54
August	275.65	509.25	16.10	64.76		865.76
September	209.20	414.80		426.39	$4,216.33	5,266.72
October	200.00	487.00		33.02		720.02
November	288.38	487.00		64.06		789.44
December	213.80	342.00	25.39	35.03		616.22
1905.						
January	38.55			68.10		106.65
Febuuary	380.90	810.25	161.21	5.00		1,357.36
March	39.57		62.77	5.00		107.34
April	131.39	217.00		72.23		420.62
May	188.43	501.34	6.75	47.38		738.90
June	212.00	465.00	2,231.46	377.97		3,286.43
Total	2,382.87	4,644.31	2,602.55	1,213.94	4,216.33	15,000.00

I I 8.

IMPROVEMENT OF HARBOR AT MARQUETTE, MICHIGAN.

For a history of this harbor, see Annual Reports of the Chief of Engineers for previous years.

Under the provisions of the act of Congress approved June 13, 1902, and the sundry civil act of March 3, 1903, work has continued upon the construction of concrete superstructure for the breakwater in accordance with the authorized project.

For detailed description of this concrete work, with drawings, photographic views, cost, etc., see the Annual Reports for 1896, pages 2365 to 2385; 1897, pages 2615 to 2638, and 1898, pages 2252 to 2282. The Annual Report for 1904, pages 2775 and 2776, gives a description and cross-section of the latest portion of the work, which includes certain modifications in the method of construction found advisable by experience during the earlier progress.

The work of construction for the season of 1904 began in April and was continued until October 31, in which time there was built 1,070 linear feet of concrete superstructure, in which about 6,000 yards of concrete were used. Of this distance built, 950 linear feet was at the south end of the work and 120 feet at the north end, forming the shore-end extension. Of the foregoing 1,070 linear feet, 820 linear feet were built after June 30, 1904. The construction included the difficult and tedious work of removing old work and preparing a foundation in a depth of 2 to 3 feet of water.

The gallery floor in the older portion of the superstructure was in September raised 4 to 8 inches for a distance of 1,500 feet by building up with concrete, and the floor in the first 200 feet of the 1903 work, where old forms were used, was raised 2 inches by laying cement and sand mortar. This was done to bring the gallery floor above the high-water level and make it uniform in height. This leaves a clear height of 5½ feet in the gallery throughout the entire length of the superstructure. Ninety-one yards of concrete was used in raising the floor.

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In November, 1904, a protection wall was built along the lake-shore extension for a distance of about 100 feet northerly from the north end of the breakwater. This wall is of rubble masonry.

A roadway was built to the life-saving station boathouse to replace one that had been torn up in the construction of the shore-end extension.

Soundings were taken on both sides of the breakwater along the portion of breakwater where the superstructure was built in 1903 and 1904, and mapped, to show the condition of the riprap slopes.

The concrete superstructure is now built to a total length of 2,920 feet, which is 97 per cent of the entire length. It stops 100 feet short of the end of the old breakwater, there not being money enough to build a pierhead of suitable design for the termination of this structure.

There are reasons why this work can not be completed within the limit set by law, which should be stated here:

(*a*) A project was submitted by Maj. James B. Quinn, and adopted February 27, 1890, for placing a concrete superstructure on the existing breakwater, at a cost of $232,936.71.

(*b*) Appropriations were made from time to time, and finally in the river and harbor act of June 13, 1902, provision was made that $7,500 of the appropriation might be expended in improving harbor of refuge at Marquette Bay, and the total amount so authorized was expended at that point.

(*c*) This left the appropriation for Marquette Harbor $7,500 short of the original estimate.

(*d*) Owing to the disadvantage of having small appropriations, at two-year intervals, for a large work, the work has cost a little more than the original estimate.

(*e*) A severe storm which swept Lake Superior December 27–28, 1904, caused considerable damage to the breakwater. It tore out five concrete footing blocks, of the small size built in 1897, tore out some of the subaqueous concrete from beneath the monolithic blocks back of the missing footing blocks, and about 400 linear feet of concrete "footing" was destroyed along the toe of the lake side of the portion built in 1895–1897, though a small portion of this footing had been destroyed previous to this storm. The decking on the remaining 100 feet of timber superstructure at the south end of the breakwater was damaged and some of the rock washed out. The work of repairing these damaged portions began June 5, 1905, and is now in progress. The probable cost will be about $4,315.

The causes of the excess in cost are therefore briefly stated, the diversion of a portion of the appropriation, the lack of continuity in carrying out the work, and the cost of maintenance.

It is now estimated that to complete the existing project a further appropriation of $15,000 will be necessary to build the pierhead.

In this connection attention is invited to my report of September 30, 1903, printed in House Executive Document No. 161, Fifty-eighth Congress, second session, and also printed in the Annual Report of the Chief of Engineers for 1904, Appendix II, page 2786, recommending a further extension of this breakwater, in which the division engineer, the Board of Engineers for Rivers and Harbors, and the Chief of Engineers, United States Army, concurred. If provision be made by Congress for this extension, no pierhead will be required at the present

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end of the breakwater, and a smaller sum, of about $8,000 only, will be needed to continue the present form of concrete superstructure over the gap of 100 feet previously mentioned.

For the maintenance of this breakwater the sum of $10,000 should be appropriated.

This work has been under the charge of F. L. Dever, United States assistant engineer during the seasons of 1903, 1904, and until June 2, 1905, when failing health made it necessary for him to resign and seek a different climate. Mr. Dever's services have been entirely satisfactory, and very efficient and creditable, and the same is true of his previous services, as I understand, at the Duluth-Superior Harbor on important work under other district officers.

The repair work mentioned in paragraph (*e*) is carried on by hired labor and the purchase of materials in open market or under public notice. The work is done by Mr. A. A. Sinclair, overseer, under the direction of Clarence Coleman, assistant engineer. Mr. Coleman's principal duties are at the Superior Entry, and he makes a journey to Marquette as occasion requires.

The sum recommended to be appropriated will be expended for maintenance.

Money statement.

July 1, 1904, balance unexpended		$43,604.13
Amount appropriated by river and harbor act approved March 3, 1905		3,000.00
		46,604.13
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$33,000.00	
For maintenance of improvement	3,954.72	
		36,954.72
July 1, 1905, balance unexpended		9,649.41
July 1, 1905, outstanding liabilities		250.00
July 1, 1905, balance available		9,399.41
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905		10,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

ABSTRACT OF APPROPRIATIONS FOR IMPROVING HARBOR AT MARQUETTE, MICH.

March 2, 1867 (allotment)	$85,000.00	August 11, 1888	$25,000.00
April 10, 1869 (allotment)	26,730.00	September 19, 1890	40,000.00
July 11, 1870	25,000.00	July 13, 1892	80,000.00
March 3, 1871	60,000.00	August 18, 1894	30,000.00
June 10, 1872	50,000.00	June 3, 1896	29,000.00
March 3, 1873	15,000.00	Deposited in United States Treasury January 28, 1896	327.76
June 23, 1874	15,000.00	July, 1898, repayment	.93
March 3, 1875	15,000.00	March 3, 1899	25,000.00
June 18, 1878	2,000.00	June 13, 1902	26,000.00
August 14, 1878	2,000.00	March 3, 1903 (sundry civil act)	80,000.00
March 3, 1879	1,500.00	March 3, 1905	3,000.00
June 14, 1880	1,000.00		
August 2, 1882	16,000.00	Total	667,558.69
July 5, 1884	5,000.00		
August 5, 1886	10,000.00		

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COMMERCIAL STATISTICS.

Receipts and shipments of Marquette, Mich. (including Presque Isle, Mich.), for calendar year 1904.

[Tons of 2,000 pounds.]

Receipts:	
Coal	193,000
Cement (11,500 barrels)	2,300
Brick (60,000)	120
Salt (3,000 barrels)	450
Oil (1,500 barrels)	300
General merchandise	12,630
Fish	375
Tanbark (1,000 cords)	1,120
Total	210,295
Shipments:	
Iron ore	2,136,176
Pig iron	40,815
Lumber (17,540 M feet)	26,310
Laths (3,750 M)	938
Total	2,204,239
Total receipts and shipments	2,414,534
Total valuation	$9,080,817

Arrivals and departures of vessels with registered tonnage, for calendar year 1904.

Class.	Arrived.	Cleared.	Estimated tonnage.	Average tonnage.
Steam	720	696	2,615,746	1,847
Tow	201	194	547,834	1,367
Total	921	890	3,163,580	1,747
Decrease	54	17	370,652	142

Total arrived and cleared, 1,811. These do not include the many boats which ran into this harbor for shelter, nor the small boats in the fish trade.

II 9.

HARBOR OF REFUGE, MARQUETTE BAY, MICHIGAN.

This harbor is also known as Presque Isle Harbor.

For the description of the locality and the interests to be benefited by the improvement, see Annual Report of the Chief of Engineers, United States Army, 1896, pages 2385, 2386.

For the work of improvement, see the Annual Reports of the Chief of Engineers, United States Army, for years 1897, 1901, and 1903. See also the current summary.

The approved projects were for building 1,000 feet of breakwater running out from Presque Isle Point (completed in 1900), and afterwards for closing a gap between said breakwater and the shore by cribwork 216 feet long (completed in 1902).

The work when last visited was in good condition, and affords

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great protection to the commercial business done in this bay. No additional work is proposed except maintenance.

The available balance, with appropriation asked for, will be used for maintenance.

Money statement.

July 1, 1904, balance unexpended	$209.42
Amount appropriated by river and harbor act approved March 3, 1905	1,000.00
July 1, 1905, balance unexpended	1,209.42
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	1,000.00

ABSTRACT OF APPROPRIATIONS FOR HARBOR OF REFUGE, MARQUETTE BAY, MICHIGAN.

June 3, 1896	$20,000
March 3, 1899	30,000
June 13, 1902	7,500
March 3, 1905	1,000
Total	58,500

COMMERCIAL STATISTICS.

Receipts and shipments during calendar year 1904 at Presque Isle Harbor, Michigan.

[Tons of 2,000 pounds.]

Receipts:	
Tanbark (1,000 cords)	1,120
Shipments:	
Iron ore	1,177,487
Pig iron	34,095
Lath (3,750 M)	938
Lumber (12,540 M feet)	18,810
Total	1,231,330
Total freight	1,232,450
Decrease from 1903	28,924
Approximate value of commerce, 1904	$3,521,433
Increase over 1903	$141,988

Arrivals and clearances of vessels for 1904.

Vessels.	Arrived.	Cleared.	Total.
Steam	285	285	570
Tow	40	40	80
Total	325	325	650

Estimated net registered tonnage, 1,250,000.
In addition, several trips of tugs with scows, etc.

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I I 10.

IMPROVEMENT OF HARBOR OF REFUGE AT GRAND MARAIS, MICHIGAN.

For a history of this harbor and the work of improvement by the Government, see Reports of the Chief of Engineers, United States Army, including 1881, Appendix E E 4, page 2038, and 1871, page 131.

Dredging in the entrance channel was done in 1904 between the dates of June 25 and July 25 by the Lake Superior Contracting and Dredging Company, under contract with the United States. Amount, 43,366 cubic yards, at 17 cents per yard, making the total contract cost $7,372.22. Of this amount of work 33,233 yards were removed after June 30, 1904, at a cost of $5,649.61.

A survey of the channel, made after the completion of the work, showed the width of dredging to be from 180 to 190 feet, with an average depth of 18½ feet at low-water datum, and a least depth, where some lumps were accidentally left by the dredge, of 16 feet. The last previous dredging was done in 1891, leaving a least depth of 17 feet for a width of 175 feet. During the succeeding interval of thirteen years the channel shoaled to a least depth in mid-channel of 13 feet and became nearly stationary at that depth.

The pile dike which closes the natural entrance was built in 1895–1897 to prevent the wearing away of the narrow sand spit which extended to the east of the artificial entrance and arrest the movement of sand from the east, both of which agencies were gradually advancing sand bars into the harbor basin. It was also expected that with the dike in place the sand brought by wave action from the easterly shore would be distributed along the dike and form a permanent sand spit. These results have been partially realized, and a ridge of sand has been formed along the easterly portion of the dike and is slowly forming farther west. The dike is, however, failing from age, and a large body of ice which piled upon it in the winter of 1903–4 destroyed about 100 feet of it at a point about 1,800 feet from the west end, where the water was 4 or 5 feet deep. Currents through this gap scoured the bottom to a depth of 10 to 12 feet below datum. This break was closed in the fall of 1904 with an embankment of riprap, and an additional 1,500 feet of the adjoining dike was strengthened by depositing an embankment of rock against it on the harbor side. The work was done by Hugh Steele, under formal contract, between the dates of September 1 and November 15. The quantity of rock placed was 6,976 tons of 2,000 pounds, at a price of $1.94 per ton. This price was high on account of a haul of 45 miles from the south side of Grand Island, there being no quarries in the vicinity of this harbor, and the placing of the rock presented some difficulty on account of shallow water on the harbor side and exposure to storms on the lake side of the dike.

The cost of this repair work was about $14,000, of which sum $5,000 was an allotment, by the Chief of Engineers, from the emergency appropriation of June 13, 1902, for river and harbor works.

It was deemed important to continue this work and protect the remainder of the exposed portion of the dike in order to save the old pile work and to hasten the formation of a sand beach. This is considered of greater immediate necessity than the extension of the

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entrance piers. Plans were prepared and advertised, and bids were opened June 26, 1905, for strengthening the dike for a distance of about 1,500 feet by building a second row of piles parallel to the old dike and 10 feet away on the harbor side of the dike, and filling the space between the old and new work with slabs and rock. Also for adding some riprap to the embankment of rock that was placed last year, which was not fully completed as to height and width, and for building about 500 feet of new embankment similar to last year's work. The lowest bidder was Powell & Mitchell, whose aggregate price was $26,200, and which has been recommended for award.

This work, if carried out, with what was done last season, will reenforce a total of 3,600 linear feet of the old dike.

It is hoped that no further work on the dike than this will be necessary, but it is possible that the riprap will settle into the sand bottom by the action of waves and require additional rock.

The present length of the west pier is 1,912 feet, and of the east pier 1,545 feet. These lengths include 100 feet of pile pier at the inner end of each. The west pier is 344 feet farther into the lake than the east pier.

On account of sand movement the 22-foot curve of depth has advanced lakeward between four and five hundred feet since the project for improvement was adopted, and this fact will entail some additional expense for pier extension to deep water.

To extend the entrance piers out to 22 feet of water, in accordance with the approved project, would now require an addition of 360 feet to the west pier, at an estimated cost of $40,320, and an addition of 704 feet to the east pier, at a cost of $78,848, or about $36,000 more than the original estimate.

The sand movement in front of the entrance is generally from the west toward the east, and it is important that the west pier be extended to deep water soon in order to shut off the encroachment of sand upon the channel from that direction. The extension of the east pier should be built after the completion of the west pier, and it is quite possible that its full extension will not be necessary.

It is proposed to expend about $30,000 of the last appropriation for maintenance in completing the reenforcement of the pile dike, as above described. The remainder of said appropriation ($20,000), together with the sum of $63,401.68 (making the $83,401.68 estimated in last annual report), recommended for works of improvement, it is proposed to expend in building the west pier of the entrance out to the 22-foot depth of water and in extending the east pier for a distance of about 385 feet, which it is hoped will be all that will be required. The $20,000 asked for maintenance will be expended on repairs to piers and dike.

Money statement.

July 1, 1904, balance unexpended		$22,603.64
Amount appropriated by river and harbor act approved March 3, 1905	50,000.00	
		72,603.64
June 30, 1905, amount expended during fiscal year, for maintenance of improvement		22,763.94
July 1, 1905, balance unexpended		49,839.70
Amount (estimated) required for completion of existing project		63,401.68

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Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:

For works of improvement	$63,401.68	
For maintenance of improvement	20,000.00	
		$83,401.68

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

ABSTRACT OF APPROPRIATIONS FOR IMPROVING HARBOR OF REFUGE AT GRAND MARAIS, MICH.

June 14, 1880	$10,000.00	March 3, 1899	$25,000.00
March 3, 1881	20,000.00	June 6, 1900 (allotted)	384.32
August 2, 1882	40,000.00	June 13, 1902	70,000.00
July 5, 1884	35,000.00	Sale of United States property	125.00
August 5, 1886	26,250.00	June 13, 1902 (allotted)	5,000.00
August 11, 1888	50,000.00	March 3, 1905	50,000.00
September 19, 1890	50,000.00		
July 13, 1892	30,000.00	Total	455,723.32
August 18, 1894	20,000.00		
June 3, 1896	24,000.00		

COMMERCIAL STATISTICS.

Arrivals and clearances of vessels at Grand Marais, Mich., 1904.

Vessels.	Arrived.	Cleared.	Total.	Net registered tonnage.
Steam	680	675	1,355	697,600
Tow	90	90	180	120,000
Total	770	765	1,535	817,600

Increase in arrivals and clearances, 735; due partly to operations of fish tugs.

Principal articles received and shipped, 1904.

[In tons of 2,000 pounds.]

Receipts:	
Lumber (667 M feet)	1,000
Merchandise	6,000
Coal	6,000
Total	13,000
Shipments:	
Lumber (38,667 M feet)	58,000
Lath, 10,000 M	2,500
Shingles, 10,000 M	1,000
Ties (126,000)	7,000
Fish	800
Merchandise	275
Total	69,575
Total receipts and shipments	82,575
Approximate value of same	$1,821,054

Logs towed in, 750,000 feet.

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RÉSUMÉ.

Cost of operations on each work, both for fiscal year ending June 30, 1905, and since the commencement of operations, with total vessel freight and estimated value of same.

Name of work.	Amount expended during fiscal year ending June 30, 1905.	Vessel freight, 1904.	
		Tons of 2,000 pounds.	Estimated value.
Grand Marais, Minn	$138.65	[a] 64,240	$1,179,902.00
Agate Bay, Minn	790.06	5,850,298	13,532,524.00
Duluth-Superior	192,985.37	[b] 16,617,017	157,233,209.00
Port Wing, Wis	3,623.26	44,394	568,186.00
Ashland, Wis	8,397.98	[c] 3,485,328	18,725,768.00
Ontonagon, Mich	7,971.53	[d] 16,900	906,500.00
Waterway across Keweenaw Point	367.27	[e g] 2,295,922	59,008,949.00
Operating and care of same	15,000.00		
Marquette, Mich	36,954.72	[h] 2,414,534	[i] 9,080,817.00
Harbor of refuge, Marquette Bay		(1,232,450)	(3,521,433.00)
Grand Marais, Mich	22,768.94	[f] 82,575	1,821,054.00
Total	289,492.78	30,321,208	282,056,856.00

Name of work.	Date of commencement of improvement by the United States.	Total amount expended by the United States to June 30, 1905.	Vessel freight from commencement of work to Jan. 1, 1905.	
			Tons of 2,000 pounds.	Estimated value.
Grand Marais, Minn	1880	$165,172.24	179,387	$4,977,878.00
Agate Bay, Minn	1887	245,205.62	50,429,811	107,721,424.00
Duluth-Superior	1867	4,831,514.14	155,547,901	2,144,080,679.00
Port Wing, Wis	1903	25,099.33	168,213	2,311,587.00
Ashland, Wis	1887	313,544.22	55,266,276	448,289,690.00
Ontonagon, Mich	1867	357,764.17	2,735,754	72,796,024.00
Waterway across Keweenaw Point	1891	1,295,604.95	18,651,690	572,483,209.00
Operating and care of same	1891	151,557.64		
Marquette, Mich	1867	657,909.28	[h] 30,583,819	[i] 139,798,748.00
Harbor of refuge, Marquette Bay	1897	49,790.58	(11,348,440)	(28,526,749.00)
Grand Marais, Mich	1880	405,883.62	1,155,874	15,736,645.00
Total		8,499,045.79	314,718,725	3,508,195,884.00

[a], [b], [c], [d], [e], [f] do not include logs as follows: [a], 17,000,000 feet; [b], 39,020,000 feet; [c], 200,000,000 feet; [d], 1,000,000 feet; [e], 10,064,000 feet; [f], 750,000 feet.
[g] Largely freight passing through the canals.
[h] and [i] include Marquette Bay.

I I 11.

MODIFICATION OF HARBOR LINES AT DULUTH HARBOR, MINNESOTA.

UNITED STATES ENGINEER OFFICE,
Duluth, Minn., June 24, 1904.

GENERAL: Referring to my letter of March 28, 1904 (copy of which, with indorsements and inclosures,[a] is herewith), I have the honor to request a change in the harbor lines at Duluth, Minn. The change is shown and described on the inclosed map[a] of Duluth Harbor.

The reasons why this change is requested are fully set forth in the inclosed correspondence,[a] and will be seen by reference to the inclosed blueprint.[a]

[a] Not printed.

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The vacation of the portion of St. Louis avenue included in the proposed boat yard has been made, and the condemnation proceedings to obtain title to lot 201 have been gone through, the lot appraised, and, I presume, report of the case has gone to the Attorney-General.

It is desired to begin work on the boat yard as soon as possible, as the slip now occupied by the Government boats is to be shortly so occupied and filled in by the Northern Pacific Railway that it will be necessary for them to be moved to some other place.

Very respectfully,

CHAS. L. POTTER,
Captain, Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

[Second Indorsement.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS, U. S. ARMY,
Washington, July 19, 1904.

Respectfully submitted to the Secretary of War.

In course of the construction of a boat yard for use in connection with the improvement of harbor at Duluth, Minn., and Superior, Wis., it is found necessary to modify the existing harbor line as requested by the local engineer officer and shown on the accompanying chart.[a]

Concurring in the request of Captain Potter, I recommend that the harbor line be changed as proposed, and, further, that the Secretary place his approval on the chart which has been prepared for his signature.

A. MACKENZIE,
Brig. Gen., Chief of Engineers, U. S. Army.

NOTE.—The lines referred to above and shown on the map mentioned were approved by the Secretary of War July 20, 1904, the approval being indicated on the map.

[a] Not printed.

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APPENDIX J J.

IMPROVEMENT OF RIVERS AND HARBORS ON THE NORTHERN AND WESTERN SHORES OF LAKE MICHIGAN.

REPORT OF MAJ. J. G. WARREN, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1905, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Manistique Harbor, Michigan.
2. Gladstone Harbor, Michigan.
3. Menominee Harbor and River, Michigan and Wisconsin.
4. Oconto Harbor, Wisconsin.
5. Greenbay Harbor, Wisconsin.
6. Sturgeon Bay and Lake Michigan Ship Canal, and harbor of refuge connected therewith, Wisconsin.
7. Operating and care of Sturgeon Bay and Lake Michigan Ship Canal, Wisconsin.
8. Ahnapee (Algoma) Harbor, Wisconsin.
9. Kewaunee Harbor, Wisconsin.
10. Two Rivers Harbor, Wisconsin.
11. Manitowoc Harbor, Wisconsin.
12. Sheboygan Harbor, Wisconsin.
13. Port Washington Harbor, Wisconsin.
14. Harbor at Milwaukee, Wisconsin, including harbor of refuge.
15. Milwaukee Inner Harbor, Wisconsin.
16. South Milwaukee Harbor, Wisconsin.
17. Racine Harbor, Wisconsin.
18. Kenosha Harbor, Wisconsin.
19. Waukegan Harbor, Illinois.
20. Fox River, Wisconsin.
21. Operating and care of locks and dams on Fox River, Wisconsin.
22. Removing sunken vessels or craft obstructing or endangering navigation.

UNITED STATES ENGINEER OFFICE,
Milwaukee, Wis., July 15, 1905.

GENERAL: I have the honor to transmit herewith annual report for the works of river and harbor improvement in my charge for the fiscal year ending June 30, 1905.

Very respectfully, your obedient servant,

J. G. WARREN,
Major, Corps of Engineers.

Brig. Gen. A. MACKINZIE,
Chief of Engineers, U. S. A.

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JJ 1.

IMPROVEMENT OF MANISTIQUE HARBOR, MICHIGAN.

The natural condition of this work and projects for its improvement are described and references for more extended information are given in current summary, Annual Report of the Chief of Engineers for 1905, page 524.

Operations during the fiscal year.—A survey of the harbor is in progress at the close of the fiscal year. The purpose of this survey is to obtain accurate information as to the depth of the underlying rock in the harbor before preparing detailed plans for its improvement.

Condition of the improvement.—No soundings have been taken in the channel since the completion of the survey of 1903. It is believed that the condition of the channel is practically the same as at that time, which is fully described in report on said survey and to which reference is made in current summary, page 525.

Remarks.—The funds available are insufficient to permit of any improvement to this harbor which would be of material benefit to general commerce. If they were expended in pier construction, the cost of same probably would be materially greater than the original estimate, which was made on the supposition that the work would be carried on continuously. The approved project provides for concrete superstructures on timber cribs. This kind of work can not be done economically unless the operations can be carried on with some degree of continuity.

If the available funds are expended in dredging, the probable result would be that the dredged channel, being largely unprotected, would soon fill up, and the temporary benefit to general commerce would be entirely lost.

The harbor at Manistique, Mich., is at present a private enterprise, and is maintained and lighted by private parties. It is believed that if the United States begins operations there under the provisions of the act of March 3, 1905, it will assume the responsibility for maintaining and lighting the whole harbor, and necessarily expend funds for maintenance before any appreciable amount of work has been done upon the improvement.

It is therefore recommended that if the approved project of improvement is to be carried out by the Government, the balance of the estimate remaining unappropriated and amounting to $245,000 be made available.

Money statement.

July 1, 1904, balance unexpended		$2,044.95
Amount appropriated by river and harbor act approved March 3, 1905		25,000.00
		27,044.95
June 30, 1905, amount expended during fiscal year, for works of improvement		372.26
July 1, 1905, balance unexpended		26,672.69
July 1, 1905, outstanding liabilities		117.00
July 1, 1905, balance available		26,555.69
Amount (estimated) required for completion of existing project		245,000.00

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Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905 ..... $245,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.

APPROPRIATIONS.

June 14, 1880	$5,000
March 3, 1881	1,000
March 3, 1905	25,000
Total	31,000

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR ENDING DECEMBER 31, 1904.

[Furnished by Mr. E. W. Miller, deputy collector of customs, Manistique, Mich.]

Arrivals and departures of vessels.

Description.	Arrivals.	Departures.
Steam	43	47
Sail	106	106
Total	149	153

NOTE.—The report of arrivals and departures of vessels does not include the operations of car ferries, as in plying between Manistique, Ludington, and Frankfort, Mich., they are trading within the Manistique district and are not required to report and clear from the port of Manistique, Mich.

By way of the harbor.

	Tons.
Exports	194,607
Imports	124,545
Total	319,152

Principal articles of export.—Lath and pickets, flour, grain, and general merchandise.

Principal articles of import.—Coal and general merchandise.

J J 2.

IMPROVEMENT OF GLADSTONE HARBOR, MICHIGAN.

The natural condition of this work and project for its improvement are described and references for more extended information are given in current summary, Annual Report of the Chief of Engineers for 1905, page 525.

Operations during the fiscal year.—Work under the contract with Joseph Wolter for dredging 85,000 cubic yards, more or less, was commenced June 14, 1905, and is in progress at the close of the fiscal year. The total amount dredged under this contract is 17,853 cubic yards. The price per cubic yard is 13 cents.

Condition of the improvement.—It is not known what, if any, changes in depths have taken place since the completion of the survey in 1903. The dredging now in progress is not sufficiently advanced to be of any material benefit as yet.

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Remarks.—The project of improvement will be completed under the contract now in force.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1905	$14,000.00
June 30, 1905, amount expended during fiscal year, for works of improvement	133.43
July 1, 1905, balance unexpended	13,866.57
July 1, 1905, amount covered by uncompleted contracts	11,050.00

APPROPRIATION.

March 3, 1905 ..... $14,000

CONTRACT IN FORCE.

For dredging 85,000 cubic yards, more or less, at 13 cents per cubic yard.
Name of contractor: Joseph Wolter.
Date of contract: June 3, 1905.
Date of approval: July 12, 1905.
Date of commencement: June 14, 1905.
Date of completion: October 14, 1905.

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR ENDING DECEMBER 31, 1904.

[Furnished by Mr. W. M. Kellie, Supt. M., St. P. & S. Ste. Marie Ry. Co.]

Arrivals and departures of vessels.

Description.	Arrivals.	Departures.
Steam	179	178
Sail	31	31
Total	210	209

By way of the harbor.

	Tons.
Exports	198,455
Imports	295,781
Total	494,236

Principal articles of export.—Barley, flour, lumber, oats, and shingles.
Principal articles of import.—Coal and general merchandise.

JJ 3.

IMPROVEMENT OF MENOMINEE HARBOR AND RIVER, MICHIGAN AND WISCONSIN.

The natural condition of this work and projects for its improvement are described and references for more extended information are

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given in current summary, Annual Report of Chief of Engineers for 1905, page 526.

Operations during the fiscal year.—During February and March soundings were taken through the ice and a map of the harbor prepared. These soundings covered the channel from a point about 200 feet above Ogden Street Bridge to the pierheads, and also an area outside the pierheads of about 4,900 feet by 5,200 feet.

Condition of the improvement.—Between the pierheads and Ogden Street Bridge there are numerous shoals with depths less than 20 feet over them. Vessels drawing 19 feet will probably experience no material difficulty in navigating the channel.

Remarks.—The act of March 3, 1905, provided for "such modifications of the existing project as may seem best to save expense and subserve the interests of commerce."

In accordance with the foregoing, the project has been modified by omitting therefrom the improvement by the Government of all that portion of the Menominee River lying above and to the westward of Ogden Street Bridge.

About 1,050 linear feet of the harbor piers require rebuilding above the water line. Preliminary arrangements for this work have been made, and it is proposed to do the work by hire of labor and purchase of materials.

The funds available are believed to be sufficient to do the foregoing work, but are insufficient for both that and for maintenance of channel and existing works to June 30, 1907.

The following estimate is therefore submitted:

For dredging 30,000 cubic yards, at 13 cents	$3,900
For minor repairs to piers	1,000
For contingencies and superintendence	600
Total	5,500

Money statement.

July 1, 1904, balance unexpended	$12,356.32
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	1,209.21
July 1, 1905, balance unexpended	11,147.11
July 1, 1905, amount covered by uncompleted contracts	2,587.44
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	5,500.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

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APPROPRIATIONS.

Harbor.

March 3, 1871	$25,000.00	
June 10, 1872	25,000.00	
March 3, 1873	25,000.00	
June 23, 1874	25,000.00	
March 3, 1875	25,000.00	
August 14, 1876	8,000.00	
June 18, 1878	10,000.00	
March 3, 1879	10,000.00	
June 14, 1880	10,000.00	
March 3, 1881	12,000.00	
August 3, 1882	15,000.00	
July 5, 1884	10,000.00	
August 5, 1886	3,000.00	
August 11, 1888	9,000.00	
August 18, 1894	10,000.00	
June 3, 1896	7,150.00	
March 3, 1899	5,500.00	
		$234,650.00

River.

September 19, 1890	54,000.00	
July 13, 1892	20,500.00	
August 18, 1894	6,000.00	
June 3, 1896	15,000.00	
March 3, 1899	18,920.00	
		114,420.00

Harbor and river.

June 13, 1902	50,350.00
Miscellaneous receipts credited to appropriations	1,669.03
Total	401,089.03

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR ENDING DECEMBER 31, 1904.

[Furnished by Mr. J. W. Laughrey, deputy collector of customs, Marinette, Wis., and the deputy collector of customs, Menominee, Mich.]

Arrivals and departures of vessels.

Description.	Arrivals.	Departures.
Steam	476	477
Sail	329	334
Total	805	811

By way of the harbor.

	Tons.
Exports	227,467
Imports	84,789
Total	312,256
Tonnage in calendar year ending December 31, 1903	1,381,754
Decrease in 1904	1,069,498

Principal articles of export.—Lumber, salt, ties, and general merchandise.
Principal articles of import.—Coal and coke, fence posts, sugar beets, and general merchandise.

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J J 4.

IMPROVEMENT OF OCONTO HARBOR, WISCONSIN.

The natural condition of this harbor and projects for its improvement are described and references for more extended information and maps given in current summary, Annual Report of Chief of Engineers for 1905, page 527.

Operations during the fiscal year.—There were no operations.

Condition of the improvement.—No material change in the condition of this improvement has occurred since June 30, 1902. (See Annual Report for 1902, p. 2046.)

Proposed operations.—It is proposed to apply the funds available in maintenance of the south pier.

Money statement.

July 1, 1904, balance unexpended	$3,650.23
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	4.88
July 1, 1905, balance unexpended	3,645.35
Amount (estimated) required for completion of existing project	22,610.00

APPROPRIATIONS.

March 3, 1881	$10,000	August 18, 1894	$3,000
August 2, 1882	15,000	June 3, 1896	4,000
July 5, 1884	15,000	March 3, 1899	15,000
August 5, 1886	8,000	June 13, 1902	3,000
August 11, 1888	20,000		
July 13, 1892	3,000	Total	96,000

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR ENDING DECEMBER 31, 1904.

[Furnished by Mr. W. A. Holt, mayor of Oconto, Wis.]

Principal articles of export.—Lumber, wood, hay, and general merchandise.

Principal articles of import.—Coal and coke, stone, hay, land plaster, and general merchandise.

Owing to condition of harbor, exports and imports by water were limited to some small vessels which brought hay, grain, and fruit, and took back lumber.

J J 5.

IMPROVEMENT OF GREEN BAY HARBOR, WISCONSIN.

The natural condition of this work and projects for its improvement are described and reference for more extended information are given in current summary, Annual Report of the Chief of Engineers for 1905, page 528.

Operations during the fiscal year.—U. S. dredge *No. 1* was employed from July 2 to August 24, 1904, in removing shoals with less than 19 feet of water over them. The amount so removed was 32,042 cubic yards at a cost of 8.8 cents per cubic yard.

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Condition of the improvement.—There are numerous shoals having a depth less than 20 feet over them, but vessels drawing 19 feet will probably have no difficulty in navigating the channel.

Remarks.—The project for the improvement of this harbor is completed.

It is believed that the funds available are sufficient for the maintenance of channel and existing works to June 30, 1907, and therefore no estimate is submitted.

Money statement.

July 1, 1904, balance unexpended	$5,708.71
Amount appropriated by river and harbor act approved March 3, 1905	10,000.00
	15,708.71
October 1, 1904, amount allotted from appropriation for maintenance of river and harbor improvements, act of June 13, 1902, returned to Treasury United States	2,671.61
	13,037.10
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	2,679.07
July 1, 1905, balance unexpended	10,358.03

APPROPRIATIONS.

June 23, 1866	$30,500.00	August 11, 1888	$10,000.00
March 2, 1867	45,000.00	September 19, 1890	10,000.00
July 25, 1868 (allotted)	17,500.00	July 13, 1892	25,000.00
April 10, 1869 (allotted)	44,550.00	August 18, 1894	25,000.00
July 11, 1870	17,500.00	June 3, 1896	25,000.00
March 3, 1871	17,500.00	July 19, 1897	5,000.00
March 3, 1873	20,000.00	March 3, 1899	28,600.00
June 23, 1874	10,000.00	June 13, 1902	105,600.00
March 3, 1875	10,000.00	June 13, 1902 (allotment from emergencies, river and harbor)	2,328.39
August 14, 1876	8,000.00	March 3, 1905	10,000.00
June 18, 1878	5,000.00	Miscellaneous receipts credited to appropriation	52.50
March 3, 1879	4,000.00		
June 14, 1880	6,000.00		
March 3, 1881	5,000.00		
August 2, 1882	20,000.00		
July 5, 1884	10,000.00		
August 5, 1886	7,000.00	Total	524,130.89

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR ENDING DECEMBER 31, 1904.

[Furnished by Mr. M. J. McCormick, Green Bay, Wis.]

Arrivals and departures of vessels.

Description.	Arrivals.	Departures.
Steam and sail	1,370	1,371

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By way of the harbor.

	Tons.
Exports	562,974
Imports	961,240
Total	1,524,214
Tonnage in calendar year ending December 31, 1903	1,387,806
Increase	136,408

Principal articles of export.—Coal and coke, brick, flour, grain, wood, and general merchandise.

Principal articles of import.—Coal and coke, lumber, salt, wood, and general merchandise.

JJ 6.

IMPROVEMENT OF STURGEON BAY AND LAKE MICHIGAN SHIP CANAL AND HARBOR OF REFUGE CONNECTED THEREWITH, WISCONSIN.

The natural condition of this work and projects for its improvement are described and references for more extended information and maps are given in current summary, Annual Report of the Chief of Engineers for 1905, page 529.

Operations during the fiscal year.—Work under the contract with the Duluth Dredge and Dock Company for dredging and rock removal was completed July 14, 1904, and the contract closed. Under this contract there was dredged 1,646,977 cubic yards, of which amount 49,766 cubic yards was dredged during the fiscal year, and 3,436.67 cubic yards of rock was removed, none of which was done during the fiscal year. The cost of the dredging was $163,050.73, of which amount $41,512.67 was expended during the fiscal year. The cost of rock removal was $18,901.69, of which amount $1,890.16 was expended during the fiscal year. The price paid for dredging was 9.9 cents per cubic yard, and for rock removal, $5.50 per cubic yard.

The superstructure of the detached portion of the north pier of harbor of refuge at easterly entrance to the canal was rebuilt. The work, which was begun August 20 and completed October 27, 1904, was done by hire of labor and purchase of materials, at a cost of $1,060.37.

Condition of the improvement.—With the exception of about 500 feet in the vicinity of the bridge, the channel has been dredged to the full projected depth for its entire length. There are numerous shoals in the dredged channel, however, the shoalest spot being about 1,800 feet easterly from the bridge in mid-channel, where the minimum depth is about 17.8 feet. For governing depth in through channel, see page 529 of this report. (Operating and care of Sturgeon Bay and Lake Michigan Ship Canal, Wisconsin.)

Remarks.—Preliminary arrangements have been made for rebuilding about 1,100 linear feet of timber superstructure on the piers inclosing the harbor of refuge. It is proposed to do this work by hire of labor and purchase of materials.

When the bridge across Sturgeon Bay shall have been removed or rebuilt, as provided for by the act of March 3, 1905, the remainder of

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the channel will be dredged to the projected depth of 21 feet below datum.

When the foregoing work shall be done the present project of improvement will be completed. The funds available are sufficient for that purpose, and therefore no estimate is submitted.

Money statement.

July 1, 1904, balance unexpended		$75,640.07
Amount appropriated by river and harbor act approved March 3, 1905		50,000.00
		125,640.07
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$47,268.96	
For maintenance of improvement	1,060.37	
		48,329.33
July 1, 1905, balance unexpended		77,310.74
July 1, 1905, amount covered by uncompleted contracts		2,049.96

APPROPRIATIONS.

Harbor of refuge.

March 3, 1873	$40,000.00	
March 23, 1874	10,000.00	
June 18, 1878	30,000.00	
March 3, 1879	30,000.00	
June 14, 1880	10,000.00	
March 3, 1881	10,000.00	
August 2, 1882	20,000.00	
July 5, 1884	10,000.00	
August 5, 1886	5,000.00	
September 19, 1890	3,000.00	
July 13, 1892	5,000.00	
August 18, 1894	5,000.00	
June 3, 1896	5,000.00	
March 3, 1899	5,500.00	
		$188,500.00

Canal.

July 13, 1892	$81,833.00	
August 18, 1894	20,000.00	
June 3, 1896	30,000.00	
March 3, 1899	30,000.00	
		161,833.00

Canal and harbor of refuge.

June 13, 1902	$44,000.00	
March 3, 1903	178,000.00	
March 3, 1905	50,000.00	
		272,000.00
Miscellaneous receipts credited to appropriations		12,076.56
Total		634,409.56

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COMMERCIAL STATISTICS FOR THE CALENDAR YEAR ENDING DECEMBER 31, 1904.

[Furnished by Mr. Adam N. Dier, superintendent Sturgeon Bay and Lake Michigan Ship Canal, Wisconsin.]

Arrivals and departures of vessels.

Class.	From Lake Michigan to Green Bay.		From Green Bay to Lake Michigan.		Total.	
	Number.	Net tons.	Number.	Net tons.	Number.	Net tons.
1904.						
Steam	762	417,730	675	341,648	1,437	759,378
Sail	308	42,668	245	27,846	553	70,509
Unrigged	227	256,355	236	262,449	463	518,804
Total	1,297	716,748	1,156	631,943	2,453	1,348,691
1903	1,571	812,755	1,435	733,872	3,006	1,546,627
1902	1,708	869,961	1,592	771,753	3,300	1,640,714
1901	1,986	922,652	1,776	764,666	3,752	1,687,318
1900	1,760	749,944	1,693	684,927	3,453	1,434,871
1899	2,015	785,378	1,825	631,734	3,840	1,417,112
1898	1,921	669,641	1,855	616,244	3,776	1,285,885

Navigation through the canal for the season of 1904 was resumed April 11, and was practically closed December 16, a period of 249 days.

Average number of craft passing through the canal per day for the whole season (not including tugs)	9.85
Average net tons passing through the canal per day for the whole season (not including tonnage of tugs)	5,416.43
Average net tonnage of—	
Steam craft	528.44
Sail craft	125.69
Unrigged craft	1,120.52

Statement of freight and passengers carried through the canal during the calendar year ending December 31, 1904.

FROM LAKE MICHIGAN TO GREEN BAY.

Articles.	Net tons.	Articles.	Net tons.
Agricultural implements	379	Hay	1,597
Beets (sugar)	495	Iron (manufactured)	15,560
Cement	990	Merchandise (general)	46,378
Coal (all kinds)	55,895	Posts (fence and paving)	570
Fish	4,731	Potatoes	920
Flour	10	Salt	10,743
Fruit	2,059		
Glass	70	Total	140,547
Grain (all kinds)	360	Passengers.....number..	5,984

FROM GREEN BAY TO LAKE MICHIGAN.

Agricultural implements	40	Merchandise (general)	13,897
Bark	2,307	Paper	1,134
Barrels (empty)	68	Poles (telegraph)	24,848
Coal (all kinds)	12,673	Posts (fence and paving)	4,910
Dairy products	238	Potatoes	1,440
Fish	2,284	Salt	1,213
Grain (all kinds)	4,828	Sawdust	300
Hay	598	Stone (building and crib)	96,701
Hides	173	Ties (railroad)	18,790
Iron (manufactured)	308	Wood	14,098
Iron (pig)	1,384		
Iron (scrap)	165	Total	422,805
Logs	900	Passengers.....number..	6,382
Lumber	219,528		

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Total number of net tons of freight carried through the canal during the calendar year ending December 31, 1904 563,352
Total number of passengers carried through the canal during the calendar year ending December 31, 1904 12,316

Statement showing quantity and estimated value of freight carried through the canal during the calendar year ending December 31, 1904.

Items.	Quantity.	Price per unit.	Total valuation.
Agricultural implements ..... tons	419	$200.00	$83,800.00
Bark ..... cords	2,097	8.00	16,776.00
Barrels (empty) ..... number	2,500	.75	1,875.00
Beets (sugar) ..... tons	495	6.00	2,970.00
Cement ..... do	990	30.00	29,700.00
Coal (all kinds) ..... do	68,558	4.00	274,232.00
Dairy products ..... do	238	300.00	71,400.00
Fish ..... do	7,015	100.00	701,500.00
Flour ..... do	10	50.00	500.00
Fruit ..... do	2,059	60.00	123,540.00
Glass ..... do	70	300.00	21,000.00
Grain:			
Corn ..... bushels	1,000	.75	750.00
Peas ..... do	171,750	1.25	214,687.50
Hay ..... tons	2,195	9.00	19,755.00
Hides ..... do	173	140.00	24,220.00
Iron:			
Manufactured ..... do	15,863	65.00	1,031,095.00
Pig ..... do	1,384	30.00	41,520.00
Scrap ..... do	165	5.00	825.00
Logs ..... M feet B. M	300	16.00	4,800.00
Lumber ..... do	146,352	27.00	3,951,504.00
Merchandise (general) ..... tons	60,275	175.00	10,548,125.00
Paper ..... do	1,134	60.00	68,040.00
Poles (telegraph) ..... number	146,165	4.00	584,660.00
Posts (fence and paving) ..... do	288,400	.20	57,680.00
Potatoes ..... bushels	56,000	.50	28,000.00
Sawdust ..... tons	300	4.00	1,200.00
Salt ..... do	11,956	18.00	215,208.00
Stone (building and crib) ..... do	96,701	.95	91,865.95
Ties (railroad) ..... number	268,434	.30	80,530.20
Wood ..... cords	5,637	6.50	36,640.50
Total			18,329,399.15

Comparative statement of principal items of commerce through the canal for the calendar years 1903 and 1904.

Items.	Year.		Increase.	Decrease.
	1903.	1904.		
Vessels ..... number	3,006	2,453		553
Tonnage ..... tons	1,546,627	1,348,691		197,936
Tonnage (cargo) ..... do	604,798	563,352		41,446
Passengers ..... number	18,627	12,316		6,311
Agricultural implements ..... tons	217	419	202	
Bark ..... cords	90	2,097	2,007	
Coal (all kinds) ..... tons	68,283	66,558		275
Fish ..... do	1,259	7,015	5,756	
Fruit ..... do	1,592	2,059	467	
Grain (all kinds) ..... bushels	314,764	172,750		142,014
Hay ..... tons	577	2,195	1,618	
Iron:				
Manufactured ..... do	11,400	15,863	4,463	
Pig ..... do	150	1,384	1,234	
Logs ..... M feet B. M	1,601	300		1,301
Lumber ..... do	185,625	146,352		39,273
Merchandise (general) ..... tons	67,208	60,275		6,933
Paper ..... do	830	1,134	304	
Poles (telegraph) ..... number	74,326	146,165	71,839	
Posts (fence and paving) ..... do	161,490	288,400	106,910	
Potatoes ..... bushels	1,500	56,000	54,500	
Salt ..... tons	7,092	11,956	4,864	
Stone (building and crib) ..... do	97,915	96,701		1,214
Ties (railroad) ..... number	167,000	268,434	101,434	
Wood ..... cords	9,178	5,637		3,541

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Estimated value of freight passing through the canal during the calendar year ending December 31, 1904	$18,329,399.15
Estimated value of freight passing through the canal during the calendar year ending December 31, 1903	18,936,372.35
Decrease in value of freight in 1904 as compared with 1903	606,973.20

Statement showing number and net tonnage of tugs passing through the canal during the calendar year ending December 31, 1904, and the number of vessels and unrigged craft towed during that time.

FROM LAKE MICHIGAN TO GREEN BAY.

Month.	Number.	Net tons.	Vessels towed.	Unrigged towed.
April	13	295		6
May	37	1,101	4	21
June	26	748	7	12
July	37	1,310	2	15
August	27	1,405	1	14
September	24	1,105	2	22
October	32	737	8	4
November	27	595	2	9
December	20	505	2	4
Total	243	7,801	28	107

FROM GREEN BAY TO LAKE MICHIGAN.

April	15	343		1
May	38	1,119	5	21
June	30	866	9	28
July	44	1,527	3	28
August	31	1,434	2	19
September	23	1,042	4	12
October	42	985	2	18
November	26	578	9	4
December	17	417		2
Total	266	8,311	34	122

Total number of trips made through canal by tugs for whole season	509
Total number of net tons	16,112
Total number of vessels towed	57
Total number of unrigged craft towed	229
Total number of vessels and unrigged craft towed	286
Average net tonnage of tugs stationed at canal	25.75
Average number passing through canal per day for whole season	2.04
Number of tugs stationed at canal engaged in local towing	3
Tonnage of tugs stationed at the canal for local towing	77
Length of towing route from harbor entrance to mouth of Sturgeon Bay—miles	8.75

Statement of class and net tonnage of vessels coming in from the lake via the canal during the year to seek shelter in Sturgeon Bay from storms.

Month.	Steam.		Sail.		Unrigged.		Total	
	Number.	Net tons.	Number.	Net tons.	Number.	Net tons.	Number.	Net tons.
April	1	1,677					1	1,677
May	8	552	15	1,027	1	750	19	2,329
June	3	451	21	2,148	1	800	25	3,399
July	3	987	17	1,795			20	2,782
August	2	988	14	1,805	1	700	17	2,943
September	7	651	11	1,461	6	5,300	24	7,412
October	8	5,536	16	1,557	3	3,400	27	10,493
November	8	4,381	22	4,179	3	2,800	33	11,360
December	1	762	5	866	1	1,200	7	2,828
Total	36	15,985	121	14,338	16	14,950	173	45,223

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Average net tonnage of steam craft sheltered	442.62
Average net tonnage of sail craft sheltered	118.49
Average net tonnage of unrigged craft sheltered	934.37

Class, quantity, and estimated value of cargoes carried by vessels while sheltered in Sturgeon Bay, season of 1904, only those coming in from the lake via the canal being included.

Items.		Quantity.	Price per unit.	Total valuation.
Bark	cords	61	$8.00	$488.00
Coal, all kinds	tons	11,283	4.00	45,132.00
Fish	do	113	100.00	11,300.00
Flour	barrels	100	6.00	600.00
Hay	tons	142	9.00	1,278.00
Iron, manufactured	do	1,357	65.00	88,205.00
Lumber	M feet B. M.	15,213	27.00	410,751.00
Merchandise, general	tons	1,553	175.00	271,775.00
Potatoes	bushels	7,200	.50	3,600.00
Stone, building and crib	tons	9,385	.85	8,077.10
Ties, railroad	number	54,842	.30	16,452.60
Wood	cords	2,695	6.50	17,517.50

Total estimated value of cargo carried by craft sheltered	$933,597.75
Total estimated value of vessels sheltered (based on Lloyd's valuation and is approximate)	1,655,850.00
Total value of vessels and cargo	2,589,447.75

Principal lines of transportation using the canal during the past year and number and net tonnage of boats composing each line.

Name of line.	Port of hail.	Number of boats.	Net tonnage.
Toledo, Ann Arbor and Northern Michigan R. R. Co.	Toledo, Ohio	3	3,959
Lackawana Transportation Co.	Buffalo, N. Y.	2	2,889
Lake Michigan Car Ferry Transportation Co	Chicago, Ill	4	3,739
Goodrich Transportation Co.	do	7	5,411
Edward Hines Lumber Co.	do	7	2,453
Arthur Gurley Lumber Co	do	4	1,361
John Schroeder Lumber Co	Milwaukee, Wis	2	337
Hart's Steamboat Line	Green Bay, Wis	3	1,315
Leathem & Smith Towing and Wrecking Co.	Sturgeon Bay, Wis	16	6,778
Packard, Smith & Co.	do	1	736
Sturgeon Bay Stone Co.	do	5	1,730
Total		54	30,729

Of the above lines of transportation the Toledo, Ann Arbor and Northern Michigan Railroad Company, the Lackawana Transportation Company, the Goodrich Transportation Company, and Hart's Steamboat Line carry both freight and passengers; the other lines freight only.

In addition to the above lines of transportation a large number of steam barges, sail vessels, and unrigged craft engaged in the general freighting business make use of the canal continually, going both ways during the season of navigation, and considerable local business is done by tugs engaged in assisting sail vessels, unrigged craft, etc., through the canal.

JJ 7.

OPERATING AND CARE OF STURGEON BAY AND LAKE MICHIGAN SHIP CANAL, WISCONSIN.

Operations during the fiscal year.—Operations have been confined to work incident to operating and care, examinations, keeping record

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of vessels, and tonnage passing through the canal, and making necessary repairs for maintenance.

Condition of the improvement.—Navigation through the canal opened April 11, 1904; was closed on account of ice formation December 16, and was resumed April 3, 1905. There is a depth of 21 feet below datum in the canal and in the greater part of the channel between the canal and the city of Sturgeon Bay.

The governing depth of the through channel connecting Lake Michigan with Green Bay, of which the canal forms a part, is reduced to about 15.8 feet in consequence of shoal water in the draw of the bridge that spans Sturgeon Bay.

Proposed operations.—It is proposed to apply the funds for which an allotment is requested in maintenance, operating and care, and supervision of existing works.

In accordance with the provisions of section 4 of river and harbor act of July 5, 1884, a summary of expenditures is herewith given.

Money statement.

July 1, 1904, balance unexpended	$382.04
Miscellaneous receipts	163.95
Amount allotted for fiscal year ending June 30, 1905	8,379.80
	8,925.79
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	6,965.43
July 1, 1905, balance unexpended	1,960.36
July 1, 1905, outstanding liabilities	960.36
July 1, 1905, balance available	1,000.00
Amount allotted for expenditure in fiscal year ending June 30, 1906	12,018.50
Amount available for fiscal year ending June 30, 1906	13,018.50

Allotments from appropriation for operating and care of canals and other works of navigation (indefinite), act of July 5, 1884, applied to Sturgeon Bay and Lake Michigan Ship Canal, Wisconsin.

May 5, 1893	$1,415.83	July 17, 1900	$37,515.54
July 22, 1893	20,500.00	July 19, 1901	8,501.68
July 19, 1894	10,301.13	July 21, 1902	14,867.67
July 20, 1895	12,359.66	July 13, 1903	7,937.98
August 10, 1896	17,513.84	July 8, 1904	8,379.80
July 21, 1897	12,873.77	Miscellaneous receipts credited to appropriations	561.93
July 28, 1898	27,435.79		
September 16, 1898	3,000.00	Total	215,215.91
July 24, 1899	23,551.29		
September 19, 1899	7,500.00		
January 27, 1900	1,000.00		

Summary of expenditures made from appropriation for operating and care of canals and other works of navigation (indefinite), act of July 5, 1884, applied to Sturgeon Bay and Lake Michigan Ship Canal, Wisconsin, during the fiscal year ending June 30, 1905.

Services	$5,474.11
Supplies	467.53
Materials	977.50
Miscellaneous	46.29
Total	6,965.43

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J J 8.

IMPROVEMENT OF AHNAPEE (ALGOMA) HARBOR, WISCONSIN.

The natural condition of this work and projects for improvement are described, and references for more extended information and maps are given in current summary, Annual Report of the Chief of Engineers for 1905, page 531.

Operations during the fiscal year.—By hire of labor and purchase of materials 352 linear feet of the north pier was cut down and new timber superstructure built. The cost of this work was $2,298.12, exclusive of freight on timber. The timber, amounting to 78,504 feet B. M., was purchased of the Lucas Lumber Company, Tacoma, Wash., and was shipped to Ahnapee on Government bills of lading. The cost of transportation, and which is to be paid by the United States, is not known at the present time.

Dredging for maintenance of channel was begun November 4 and completed November 23, 1904; the dredging was done by U. S. dredge *No. 1*, at a cost of 10 cents per cubic yard. The total amount of material dredged was 11,914 cubic yards.

Condition of improvement.—The channel between the piers from the harbor entrance to the shore line is of the full projected depth and width. The remainder of the channel is about as described in Annual Report for 1904, page 2823.

Remarks.—The funds available are considered sufficient for the maintenance of channel and existing works to June 30, 1907, and therefore no estimate is submitted.

Money statement.

July 1, 1904, balance unexpended	$9,199.69
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	3,675.64
July 1, 1905, balance unexpended	5,524.05
Amount (estimated) required for completion of existing project	6,266.00

APPROPRIATIONS.

March 3, 1871	$25,000	August 11, 1888	$5,000
June 10, 1872	25,000	September 19, 1890	6,000
March 3, 1875	25,000	July 13, 1892	7,000
August 14, 1876	8,000	August 18, 1894	5,000
June 18, 1878	8,000	June 3, 1896	5,000
March 3, 1879	7,000	March 3, 1899	13,000
June 14, 1880	7,000	June 13, 1902	10,000
March 3, 1881	8,000	Miscellaneous receipts credited to appropriations	220
August 2, 1882	12,000		
July 5, 1884	15,000		
August 5, 1886	15,000	Total	206,220

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COMMERCIAL STATISTICS FOR THE CALENDAR YEAR ENDING DECEMBER 31, 1904.

[Furnished by Mr. M. C. Haney, mayor of Algoma, Wis.]

Arrivals and departures of vessels.

Description.	Arrivals.	Departures.
Steam	500	500
Sail	300	300
Total	800	800

By all ways of transportation.

[About two-thirds of which is by way of the harbor.]

	Tons.
Exports	100,622
Imports	199,472
Total	300,094
Tonnage in calendar year ending December 31, 1903	117,743
Increase	182,351

Principal articles of export.—Grain, hay, railroad ties, and general merchandise.

Principal articles of import.—Coal and coke, lumber, saw logs, and general merchandise.

J J 9.

IMPROVEMENT OF KEWAUNEE HARBOR, WISCONSIN.

The natural condition of this harbor and project for its improvement is described, and references for more extended information are given in current summary, Annual Report of the Chief of Engineers for 1905, page 531.

Operations during the fiscal year.—Four hundred and fifty linear feet of the north pier and 200 linear feet of the south pier were cut down and new timber superstructure built. The work was done by hire of labor and purchase of materials at a cost of $5,236.41.

Dredging for maintenance of channel was begun November 26, 1904, and completed April 24, 1905, the work having been suspended during the winter. The dredging was done by U. S. dredge *No. 1*, at a cost of 8.1 cents per cubic yard. The total amount of material dredged was 18,189 cubic yards.

Condition of the improvement.—The channel has the full projected depth of 15 feet below datum, with a least width of about 120 feet.

Remarks.—About 450 linear feet of the south pier adjoining the portion provided with new superstructure in 1904 is in bad condition. This portion should be cut down and new timber superstructure built.

The funds available are sufficient for the maintenance of channel and for minor repairs to piers to June 30, 1907, but are insufficient for building superstructure on south pier.

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The following estimate for rebuilding superstructure is submitted:

For rebuilding 450 linear feet of pier above the water line, at $10	$4,500
For contingencies and superintendence	450
Total	4,950

Money statement.

July 1, 1904, balance unexpended	$8,308.32
Amount appropriated by river and harbor act approved March 3, 1905	3,000.00
	11,308.32
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	7,981.70
July 1, 1905, balance unexpended	3,326.62
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	4,950.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

APPROPRIATIONS.

March 3, 1881	$5,000.00	March 3, 1899	$8,800.00
August 2, 1882	12,000.00	June 13, 1902	11,000.00
July 5, 1884	18,000.00	March 3, 1905	3,000.00
August 5, 1886	10,000.00	Miscellaneous receipts credited to appropriations	52.19
August 11, 1888	10,000.00		
September 19, 1890	20,000.00		
July 13, 1892	30,000.00		
August 18, 1894	20,000.00	Total	172,852.19
June 3, 1896	25,000.00		

Appropriated by local authorities in 1881 and expended by the United States under the direction of the engineer officer in charge, $8,042.72.

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR ENDING DECEMBER 31, 1904.

[Furnished by Mr. Charles Metzner, Mayor of Kewaunee, Wis.]

Arrivals and departures of vessels.

Description.	Arrivals.	Departures.
Steam and sail	480	482

By way of the harbor.

	Tons.
Exports	337,221
Imports	220,829
Total	558,050
Tonnage in calendar year ending December 31, 1903	782,097
Decrease in 1904	224,047

Principal articles of export.—Flour, hay, peas, potatoes, wheat, and general merchandise.

Principal articles of import.—Coal and coke, cement, mill stuffs, oil, and general merchandise.

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J J 10.

IMPROVEMENT OF TWO RIVERS HARBOR, WISCONSIN.

The natural condition of this harbor and projects for its improvement are described and references for more extended information and maps are given in Annual Report of the Chief of Engineers for 1903, pages 481, 482, and 1850.

Operations during the fiscal year.—During September, 1904, minor repairs were made to the revetment along the south pier, and additional filling was deposited behind the revetment. The work was done by hire of labor and use of U. S. dredge *No. 1.* About 3,600 cubic yards was cast over by the dredge, at a cost of 21 cents per cubic yard. The filling was done under an emergency, and under extremely unfavorable weather conditions; hence the relatively high cost of same.

A bar having formed at the harbor entrance, dredging for its removal was begun April 27 and completed May 19, 1905. The amount of material dredged was 7,330 cubic yards. The work was done by U. S. dredge *No. 1*, at a cost of 12.8 cents per cubic yard.

The building of 180 linear feet of revetment along the south pier, in continuation of the revetment built under the contract with Frankman Bros. & Morris, was commenced May 31 and completed June 14, 1905. The work was done by hire of labor and use of the Government dredging and pile-driving plants, at a total cost, exclusive of filling the revetment, of $1,321.74. About 6,300 cubic yards of material was cast over by the dredge for filling behind the revetment, at a cost of 15 cents per cubic yard.

A survey of the harbor with a view to obtaining depths of 16 and 18 feet, respectively, ordered by act of March 3, 1905, was completed June 17. The cost of this survey was $248.75.

Condition of the improvement.—The channel has the full projected depth of 13 feet below datum for a minimum width of about 200 feet.

Remarks.—The project for the improvement of this harbor is now completed, and the piers are in good condition, except for a few minor repairs to the decking. It is believed the funds available are sufficient for the maintenance of channel and existing works to June 30, 1907, and therefore no estimate is submitted.

Money statement.

July 1, 1904, balance unexpended		$440.02
Amount appropriated by river and harbor act approved March 3, 1905		6,600.00
		7,040.02
June 30, 1905, amount expended during fiscal year, for maintenance of improvement		2,929.77
July 1, 1905, balance unexpended		4,110.25
July 1, 1905, outstanding liabilities		234.74
July 1, 1905, balance available		3,875.51

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APPROPRIATIONS.

March 3, 1871	$25,000	July 5, 1884	$8,000
June 10, 1872	25,000	August 11, 1888	2,500
March 3, 1873	25,000	September 19, 1890	3,000
June 23, 1874	15,000	July 13, 1892	3,000
March 3, 1875	15,000	August 18, 1894	3,000
August 14, 1876	5,000	June 3, 1896	5,000
June 18, 1878	10,000	March 3, 1899	8,000
March 3, 1879	20,000	June 13, 1902	20,000
June 14, 1880	20,000	March 3, 1905	6,600
March 3, 1881	15,000		
August 2, 1882	15,000	Total	249,100

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR ENDING DECEMBER 31, 1904.

[Furnished by the mayor of Two Rivers, Wis.]

Arrivals and departures of vessels.

Description.	Arrivals.	Departures.
Steam	296	296
Sail	136	136
Total	432	432

By way of the harbor.

	Tons.
Exports	40,777
Imports	82,069
Total	122,846
Tonnage in calendar year ending December 31, 1903	108,273
Increase in 1904	14,573

Principal articles of export.—Hay, peas, veneered goods, and wood type.
Principal articles of import.—Coal and coke, lumber, saw logs, and wood.

J J 11.

IMPROVEMENT OF MANITOWOC HARBOR, WISCONSIN.

The original condition of this harbor and projects for its improvement are described, and reference for more extended information and maps are given in current summary, Annual Report of the Chief of Engineers for 1905, page 533.

Operations during the fiscal year.—The repairs to the outer crib of the south pier which had been seriously damaged by a vessel colliding with it, and which were in progress at the beginning of the fiscal year, were completed in August, 1904. The repairs were made by Greiling Brothers, under an emergency contract, at a cost of $1,706.51, exclusive of the cost of superintendence and inspection.

Dredging for restoration of channel was begun May 22 and completed June 6, 1905. The work was done by U. S. dredge *No. 1*, at a

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cost of 8 cents per cubic yard. The amount of material dredged was 8,601 cubic yards.

Condition of the improvement.—The entrance channel has the projected depth of 20 feet below datum for a width of about 200 feet.

Remarks.—The timber superstructures of both harbor piers are in a very dilapidated condition. The funds available are sufficient to rebuild them with timber, but inasmuch as in Annual Report for 1904, page 2828, it was recommended that the new superstructures be built of concrete, and inasmuch as the subject of building concrete superstructures at various harbors on Lake Michigan has been investigated by a Board of Engineers created for that purpose, nothing has been done toward rebuilding the superstructures pending the report of said Board.

It is believed that the funds available are sufficient for maintenance of channel and existing works to June 30, 1907, and therefore no estimate is submitted.

Money statement.

July 1, 1904, balance unexpended	$4,343.69
Amount appropriated by river and harbor act approved March 3, 1905	110,000.00
	114,343.69
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	2,466.92
July 1, 1905, balance unexpended	111,876.77

APPROPRIATIONS.

August 30, 1852	$8,000.00	August 2, 1882	$10,000.00
June 23, 1866	52,000.00	July 5, 1884	15,000.00
March 2, 1867	45,000.00	August 5, 1886	15,000.00
July 25, 1868 (allotted)	17,500.00	August 11, 1888	8,000.00
April 10, 1869 (allotted)	17,820.00	September 19, 1890	8,000.00
July 11, 1870	20,000.00	July 13, 1892	28,000.00
March 3, 1871	11,000.00	August 18, 1894	20,000.00
March 3, 1873	20,000.00	June 3, 1896	44,440.00
June 23, 1874	10,000.00	March 3, 1899	3,300.00
March 3, 1875	10,000.00	June 13, 1902	45,000.00
August 14, 1876	8,000.00	March 3, 1905	110,000.00
June 18, 1878	15,000.00	Miscellaneous receipts credited to appropriations	252.72
March 3, 1879	6,500.00		
June 14, 1880	7,000.00		
March 3, 1881	4,000.00	Total	558,812.72

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR ENDING DECEMBER 31, 1904.

[Furnished by Mr. William H. Devos, collector of customs, Milwaukee, Wis.]

Arrivals and departures of vessels.

Description.	Arrivals.	Departures.
Steam and sail	1,854	1,868

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By way of the harbor.

	Tons.
Exports	895,272
Imports	609,487
Total	1,504,759
Tonnage in calendar year ending December 31, 1903	16,115,951
Decrease in 1904	14,611,192

NOTE.—The commercial statistics for 1903 were obtained from the mayor of the city of Manitowoc. For the year 1904 they were furnished by the collector of customs of Milwaukee district. It is believed that the former were in excess of the actual amount and that the latter are more nearly accurate.

Principal articles of export.—Flour, grain, mill stuffs, malt, and general merchandise.

Principal articles of import.—Coal, lumber, salt, and general merchandise.

J J 12.

IMPROVEMENT OF SHEBOYGAN HARBOR, WISCONSIN.

The original condition of this harbor and projects for its improvement are described, and reference for more extended information and for reports on examinations and surveys are given in the current summary, Annual Report for 1905, page 534.

Operations during the fiscal year.—Between August 25 and October 31, 1904, 20,164 cubic yards of material was removed from the channel and the projected depth of 21 feet below datum was obtained. The work was done by hire of labor and use of U. S. dredge *No. 1*, at a cost of 12¾ cents per cubic yard.

Work under the contract with Nelson J. Gaylord for crib-pier extension was completed November 30, 1904, and the contract closed. Under this contract the north pier was extended 200 feet and the south pier 600 feet by timber cribs, each 100 by 24 by 22½ feet, including superstructure, and placed on pile foundations. During the fiscal year the south pier was extended 400 feet. The total cost of the work under this contract was $63,689.08, exclusive of the cost of superintendence; of this amount, $38,476.28 was expended during the fiscal year.

The replacing of about 352 feet of the inshore portion of the north pier by a sheet-pile revetment was begun June 15, 1905, and is in progress at the close of the fiscal year. The work is being done by hire of labor and use of the Government dredging and pile-driving plants. About 150 linear feet of the old pier has been removed preparatory to building the new revetment, and some pile driving has been done. While not employed in removing the old pier the dredge is employed in dredging in the channel for restoration of the projected depth of 21 feet. There has been thus dredged 1,974 cubic yards, at a cost of 10 cents per cubic yard.

The pile protection at the outer end of south pier, built in 1904, was carried away during the past winter. It has been replaced, the work having been done by hire of labor and use of the Government pile-driving plant.

Condition of the improvement.—The channel between the piers has a navigable depth of 20 feet below datum, shoaling having occurred

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since the completion of dredging in 1904. The dredging now in progress will restore the channel to the full projected depth of 21 feet.

Remarks.—The present project is now completed, with the exception of an extension of 100 feet to the northerly end of the breakwater. While it is believed that an extension of 100 feet might be of some benefit, it is thought that an extension of 200 feet is really needed in order to obtain the full benefit of the breakwater. It is not deemed advisable to make a greater extension shoreward than 200 feet, for it is doubtful if any materially greater benefit will be derived therefrom, unless the extension was carried practically to the shore, in which case the cost would be very excessive and entirely disproportionate to the benefit to be obtained.

There are sufficient funds now available to permit of building the projected 100 feet extension, but for an extension of 200 feet the additional sum of $11,500 would be required. It would probably cost less proportionately to build two cribs than to build but one, as approximately the same amount of plant would be required in either case.

In view of the foregoing reasons and as the subject of further protection of this harbor against the injurious effect of northeast storms has been investigated by a Board of Engineers created for that purpose, nothing has been done toward further extension of the breakwater pending the report of said board.

About 900 feet of the north pier and about 930 feet of the south pier, being the portions of the crib piers between the pile piers and the extensions of 1904, are in bad condition. These portions of the piers are from 12 to 32 years old, and the superstructure is badly decayed. The cribs should be cut down and new superstructure built.

The following estimate for maintenance of channel and existing works for the fiscal year ending June 30, 1907, is submitted:

For cutting down and rebuilding 1,830 linear feet of timber superstructure, at $10	$18,300
For dredging 30,000 cubic yards, at 13 cents	3,900
For minor repairs to piers and breakwater	2,000
For contingencies and superintendence	2,300
Total	26,500

Money statement.

July 1, 1904, balance unexpended		$44,793.11
Amount appropriated by river and harbor act approved March 3, 1905		18,000.00
		62,793.11
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$38,251.29	
For maintenance of improvement	6,002.00	
		44,253.29
July 1, 1905, balance unexpended		18,539.82
July 1, 1905, outstanding liabilities		728.50
July 1, 1905, balance available		17,811.32
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905		26,500.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

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APPROPRIATIONS.

August 30, 1852	$10,000.00	August 2, 1882	$30,000.00
June 28, 1864 (allotted)	10,000.00	July 5, 1884	28,000.00
June 23, 1866	47,598.91	August 5, 1886	15,000.00
March 2, 1867	8,000.00	August 11, 1888	15,000.00
April 10, 1869 (allotted)	14,850.00	September 19, 1890	15,000.00
July 11, 1870	15,000.00	July 13, 1892	25,000.00
March 3, 1871	15,000.00	August 18, 1894	25,000.00
June 10, 1872	18,000.00	June 3, 1896	26,000.00
March 3, 1873	10,000.00	March 3, 1899	28,400.00
June 23, 1874	10,000.00	June 6, 1900	52,000.00
March 3, 1875	12,000.00	June 13, 1902	90,000.00
August 14, 1876	6,000.00	March 3, 1905	18,000.00
June 18, 1878	4,000.00	Miscellaneous receipts credited to appropriations	91.63
March 3, 1879	3,000.00		
June 14, 1880	7,000.00		
March 3, 1881	25,000.00	Total	582,940.54

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR ENDING DECEMBER 31, 1904.

[Furnished by Mr. Theodore Dickman, mayor of Sheboygan, Wis.]

Arrivals and departures of vessels.

Description.	Arrivals.	Departures.
Steam	641	641
Sail	264	261
Total	905	902

By way of the harbor.

	Tons.
Exports	622,956
Imports	5,102,793
Total	5,725,749
Tonnage in calendar year ending December 31, 1903	1,351,042
Increase	4,374,707

Principal articles of export.—Coal, furniture, lime and cement, lumber, and general merchandise.

Principal articles of import.—Coal and coke, bark, lumber, stone, wood, and general merchandise.

JJ 13.

IMPROVEMENT OF PORT WASHINGTON HARBOR, WISCONSIN.

The natural condition of this work and projects for its improvement are described and references for more extended information and for reports on examinations and surveys are given in current summary, Annual Report for 1905, page 535.

Operations during the fiscal year.—There were no operations other than taking soundings and preparation of map.

Condition of improvement.—The piers are built the full length contemplated, and are in fair condition. The channel and basins

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have the required depth of 13 feet below datum. A bar in mid-channel and immediately outside of the pierheads, with a least depth of 12.5 feet over it, partially obstructs the entrance.

Proposed operations.—It is proposed to apply the balance available for maintenance of existing works in dredging and for repairs to piers as may be needed from time to time.

It is believed that the funds available are sufficient for these purposes to June 30, 1907; therefore no estimate for an additional appropriation is submitted.

Money statement.

July 1, 1904, balance unexpended	$5,651.44
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	311.25
July 1, 1905, balance unexpended	5,340.19

APPROPRIATIONS.

July 11, 1870	$15,000.00	August 5, 1886	$5,000.00
March 3, 1871	15,000.00	September 11, 1888	5,000.00
June 10, 1872	15,000.00	September 19, 1890	3,000.00
March 3, 1873	15,000.00	July 13, 1892	6,500.00
June 23, 1874	10,000.00	August 18, 1894	5,000.00
March 3, 1875	10,000.00	June 3, 1896	5,500.00
August 14, 1876	8,000.00	March 3, 1899	4,400.00
June 18, 1878	5,000.00	June 13, 1902	6,000.00
March 3, 1879	7,500.00	Miscellaneous receipts credited to appropriations	68.25
June 14, 1880	20,000.00		
March 3, 1881	17,000.00		
August 2, 1882	17,000.00	Total	204,968.25
July 5, 1884	10,000.00		

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR ENDING DECEMBER 31, 1904.

[Furnished by Mr. Charles A. Mueller, mayor of Port Washington, Wis.]

Arrivals and departures of vessels.

Description.	Arrivals.	Departures.
Steam	264	261
Sail	65	65
Total	329	326

By way of the harbor.

	Tons.
Exports	12,073
Imports	48,428
Total	60,501
Tonnage in calendar year ending December 31, 1903	57,101
Increase in 1904	3,400

Principal articles of export.—Brick, chairs, furniture, and hay.

Principal articles of import.—Coal and coke, lumber, saw logs, shingles, and wood.

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J J 14.

IMPROVEMENT OF HARBOR AT MILWAUKEE, WISCONSIN, INCLUDING HARBOR OF REFUGE.

The natural condition of this work and projects for its improvement are described and references for more extended information and for reports on examinations and surveys are given in current summary, Annual Report for 1905, page 535.

Operations during the fiscal year.—Work under the contract with Mr. W. H. Gillen for construction of concrete superstructures on breakwater and north harbor pier, which was in progress at the beginning of the fiscal year, was completed November 8, 1904, and the contract closed. Under this contract the inner end of the breakwater for a distance of 2,350 feet and the inner end of the north harbor pier for a distance of 1,050 feet were provided with permanent concrete superstructures. During the fiscal year 250 feet of superstructure on the breakwater and the entire 1,050 feet of north pier superstructure were built. The total cost of the work done under this contract was $196,527.19, exclusive of the cost of superintendence and inspection. Of this amount $120,085.56 was expended during the fiscal year.

Total cost of breakwater superstructure	$118,022.55
Total cost of north pier superstructure	78,504.64
Total	196,527.19

On May 29, 1905, a new contract was entered into with Mr. W. H. Gillen for the construction of 1,100 feet, more or less, of concrete superstructure on the breakwater, and of 600 feet, more or less, of concrete superstructure on the north harbor pier. Work under this contract, which is in continuation of that completed in November, 1904, was commenced June 7, 1905, and is in progress at the close of the fiscal year. A portion of the old timber superstructure on the north pier has been removed and a few piles have been driven. No concrete has yet been made and no work has yet been done on the breakwater under this contract. No expenditures have been made under this contract except for supervision and inspection.

Condition of the improvement.—The harbor channel has the required depth of 21 feet below datum for a minimum width of 140 feet.

Remarks.—On the completion of the work now under contract the breakwater will be provided with a permanent concrete superstructure from the shore to the "fair-weather opening," a distance of 3,450 feet.

The timber superstructure for a distance of 700 feet south from the "fair-weather opening" is very dilapidated and is in an unsafe condition by reason of decay. This superstructure should be replaced with concrete at the earliest possible time.

The remainder of the timber superstructure for a distance of 3,100 feet, and which was built in 1899–1900, is in good condition, and will probably not require rebuilding for five or six years. But inasmuch as a contract for a large amount of work can be awarded at lower unit prices than for a relatively small amount, it is recommended that the entire concrete superstructure remaining to be built be awarded under a continuing contract. Estimates are accordingly submitted, on the

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basis of a continuing contract, for 700 linear feet of concrete superstructure, to be built at the earliest possible time, and for an additional 3,100 linear feet to be built later.

It is proposed that the general construction of the proposed concrete superstructure shall be similar to that already built, except that as the outer 3,000 feet of the breakwater is 30 feet wide, a relatively heavier superstructure will be required over that portion than over the portion now built and which is 24 feet wide.

On the completion of the contract now in force the entire north harbor pier will be provided with a permanent concrete superstructure.

The superstructure of the entire south pier will require rebuilding in the near future. The outer 600 feet is in a very dilapidated condition and should be rebuilt at the earliest possible time. The superstructure over the remaining portion of the south pier, 1,150 feet in length, is in fair condition, most of it having been rebuilt in 1896–1899. It will, however, require rebuilding within a few years, and it is recommended, for the same reasons as those advanced for the breakwater, that the superstructure of the entire south pier be rebuilt with concrete under a continuing contract, and estimates are accordingly submitted for 600 linear feet to be built as soon as possible, and for 1,150 linear feet to be built later.

The cribs constituting the substructure of the south pier are not provided with either pile or stone foundation, but rest directly upon the natural lake bottom. It will be necessary, therefore, to protect the cribs from being undermined by building a substantial sheet pile revetment along the channel face of the pier, similar to that already provided for the north pier. It is proposed that the general construction of the concrete superstructure shall be similar to that now built on the porth pier, except that as the outer 600 feet of the south pier is 5 or 6 feet wider than the inner 1,150 feet, the concrete superstructure over that part will be relatively heavier.

The total estimated cost of the proposed work is as follows, the prices per linear foot including contingencies:

Breakwater:		
700 linear feet concrete superstructure, cribs 24 feet wide, at $60		$42,000
100 linear feet concrete superstructure, cribs 24 feet wide, at $60	$6,000	
3,000 linear feet concrete superstructure, cribs 30 feet wide, at $75	225,000	
		231,000
Total for breakwater		273,000
Harbor:		
600 linear feet concrete superstructure, including revetment, at $90		54,000
1,150 linear feet concrete superstructure, including revetment, at $80		92,000
Total for harbor		146,000
Total for both works		419,000

An appropriation of $96,000 for maintenance for the fiscal year ending June 30, 1907, is recommended.

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Money statement.

July 1, 1904, balance unexpended	$158,979.18
Amount appropriated by river and harbor act approved March 3, 1905	150,000.00
	308,979.18
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	127,200.42
July 1, 1905, balance unexpended	181,778.76
July 1, 1905, outstanding liabilities	9.35
July 1, 1905, balance available	181,769.41
July 1, 1905, amount covered by uncompleted contracts	111,695.70
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	96,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

APPROPRIATIONS.

Straight cut.

August 30, 1852	$15,000.00
March 3, 1853	163.94
June 23, 1866	48,283.51
April 10, 1869 (allotted)	35,640.00
July 11, 1870	40,000.00
March 3, 1871	38,000.00
March 3, 1873	10,000.00
June 23, 1874	10,000.00
March 3, 1875	25,000.00
August 14, 1876	26,000.00
June 18, 1878	15,000.00
March 3, 1879	7,500.00
June 14, 1880	10,000.00
March 3, 1881	8,000.00
August 2, 1882	10,000.00
August 5, 1886 (from appropriation for harbor of refuge)	4,737.91
August 11, 1888	10,000.00
March 17, 1890 (special act)	6,100.00
September 19, 1890	6,000.00
July 13, 1892	14,000.00
August 18, 1894	7,000.00
June 3, 1896	7,000.00
March 3, 1899	26,000.00
Total expended at old river mouth and straight cut	429,825.36
Expended at former mouth of Milwaukee River	50,400.00
Total appropriated for straight cut (present harbor)	379,425.36

Harbor of refuge.

March 3, 1881		$100,000.00
August 2, 1882		100,000.00
July 5, 1884		85,000.00
August 5, 1886	$60,000.00	
From which allotted to Milwaukee Harbor	4,737.91	
		55,262.09
August 11, 1888		70,000.00
September 19, 1890		80,000.00
July 13, 1892		75,000.00

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August 18, 1894	$45,000.00
June 3, 1896	20,000.00
June 4, 1897	168,737.91
March 3, 1899	50,000.00
June 6, 1900	105,650.00
Miscellaneous receipts credited to appropriations	1,149.31
Total	955,799.31
Act of June 13, 1902 (harbor and harbor of refuge)	232,500.00
Act of March 3, 1905 (harbor and harbor of refuge)	150,000.00
Aggregate	1,768,124.67

CONTRACT IN FORCE.

For the construction of 1,100 feet of concrete superstructure on breakwater and 600 feet of concrete superstructure on north harbor pier, material to be paid for at the following rates:

Removing old superstructure and leveling cribs, at $8 per linear foot; pine timber, at $50 per M feet B. M.; pine sheet piles, at $50 per M feet B. M.; white-oak piles, at 40 cents per linear foot; Norway pine, tamarack, or rock-elm piles, at 40 cents per linear foot; wire spikes, at 5 cents per pound; wrought-iron drift-bolts and spikes, at 5 cents per pound; wrought-iron screw bolts and tie-rods, at 5 cents per pound; flat steel bars, at 5 cents per pound; round steel bars, at 5 cents per pound; wrought-iron staples, at 5 cents per pound; wire rope, at 25 cents per linear foot; broken stone and gravel filling, at $2 per cubic yard; concrete blocks, at $8 per cubic yard; No. 1 concrete in place, at $9 per cubic yard; No. 2 concrete in place, at $8 per cubic yard; removing 5 wrecked cribs, each 50 by 24 feet, for $3,000 for the work, and removing 1 wrecked crib, 100 by 24 by 22½ feet, for $1,000 for the work.

Name of contractor: William H. Gillen.
Date of contract: May 29, 1905.
Date of approval: June 6, 1905.
Date of commencement: June 7, 1905.
Date of completion: December 31, 1906.

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR ENDING DECEMBER 31, 1904.

[Furnished by Mr. William H. Devos, collector of customs, Milwaukee, Wis.]

Arrivals and departures of vessels.

Description.	Arrivals.	Departures.
Steam and sail	5,043	5,059

By way of the harbor.

	Tons.
Exports	1,543,817
Imports	3,862,730
Total	5,406,547
Tonnage in calendar year ending December 31, 1903	5,071,768
Increase in 1904	334,779

Principal articles of export.—Grain, flour, mill stuffs, and general merchandise.

Principal articles of import.—Coal, iron ore, salt, lumber, and general merchandise.

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J J 15.

IMPROVEMENT OF INNER HARBOR AT MILWAUKEE, WISCONSIN.

The natural condition of this work and projects for its improvement are described and references for more extended information are given in reports on examination and survey, published in Annual Report for 1904, part 3, page 2887.

Operations during the fiscal year.—There have been no operations during the past fiscal year.

Condition of the improvement.—The condition of the channels is believed to be practically the same as set forth in report to which reference is made.

Remarks.—On April 1, 1905, a letter was sent to the mayor of the city of Milwaukee, setting forth in detail the conditions under which the appropriation could be expended, and requesting that information be furnished as to what had been done and what was proposed to be done to carry out said conditions.

An acknowledgement of this letter was received April 11, in which the assurance was given that "the conditions of the appropriation will be complied with to the letter."

There has been no further official notification as to what action has been taken or is proposed to be taken in the premises by the city of Milwaukee. It is understood, however, that a bond issue for the purpose of raising the necessary funds has been authorized, and that preliminary steps for acquiring the land necessary for turning basins and widening channels, by direct purchase or by condemnation proceedings have been taken. It is not, however, known that any of the necessary land has been acquired.

Inasmuch as the law provides that no part of the appropriation shall be expended "unless the Secretary of War shall have satisfactory assurances that the city of Milwaukee will comply with the conditions imposed upon said municipality," and inasmuch as no notification has been received that the city of Milwaukee has formally bound itself by resolution of the common council, or otherwise, to a strict compliance with said conditions, no expenditure has been made and no contract for the carrying out of the project has been entered into, nor have proposals for same been solicited, nor has anything further been done in the matter of establishing harbor lines.

For these reasons no further appropriation is recommended at this time.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1905	$100,000.00
July 1, 1905, balance unexpended	100,000.00
Amount (estimated) required for completion of existing project	218,581.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	218,581.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

APPROPRIATION.

March 3, 1905	$100,000

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J J 16.

IMPROVEMENT OF SOUTH MILWAUKEE HARBOR, WISCONSIN.

See Annual Report of the Chief of Engineers for 1900, page 3701; for report on survey see Annual Report for 1904, Part 3, page 2903.

There were no operations during the past fiscal year.

For reasons fully set forth in report on survey, to which the foregoing reference is made, this harbor is considered unworthy of further improvement.

Money statement.

July 1, 1904, balance unexpended	$12.10
July 1, 1905, balance unexpended	12.10
Amount (estimated) required for completion of existing project	133,000.00

APPROPRIATION.

June 3, 1896	$5,000

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR ENDING DECEMBER 31, 1904.

The harbor is not available; therefore there are no imports or exports by water.

J J 17.

IMPROVEMENT OF RACINE HARBOR, WISCONSIN.

The original condition of this harbor and projects for its improvement are described, and references for more extended information are given in the current summary, Annual Report for 1905, page 538.

Operations during the fiscal year.—Work under the contract with Bennett & Schnorbach for moving cribs at southerly end of breakwater has been in progress during the fiscal year. Two cribs have been moved so as to be parallel with the north harbor pier, as shown on map. The cribs have been placed on a stone foundation. The interval between these cribs and the remainder of the breakwater has been filled with stone and decked. The dredging of the original stone foundation of these cribs, so as to secure a clear depth of 24 feet below datum, remains to be done. It is expected that the work will be completed on or about July 15. No expenditures have been made for this work except for superintendence and inspection, the contract providing for payment only on completion of the entire work.

A bar having formed at the harbor entrance, so as to seriously interfere with navigation, a special agreement was made with the Chicago and Great Lakes Towing and Dock Company for the necessary dredging to restore the projected depth. There being no funds available for this work, an allotment was made under "Emergencies in river and harbor works." The dredging was done in July, 1904. The total amount dredged was 11,924 cubic yards, at a cost of $2,384.80, not including cost of supervision and inspection. The price paid per cubic yard was 20 cents.

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On the night of June 3, 1904, the outer crib of the south pier was badly damaged by some vessel. It was necessary that the damage should be repaired before the commencement of the stormy season, and as there was no available funds for this work an allotment was made under emergencies in river and harbor works. The repairs were made by Bennett & Schnorbach during the working season of 1904 under an emergency contract, at a cost of $1,549.09, not including cost of supervision and inspection.

Condition of the improvement.—Soundings taken April 12, 1905, showed that the bar at the harbor entrance, removed in July, 1904, had again formed, the minimum depth over it being 18.5 feet below datum, and that a shoaling of from 1 to 2.5 feet had taken place over a large portion of the area of the 21-foot channel.

Remarks.—Upon the completion of the work now under contract with Bennett & Schnorbach the present project of improvement will be completed. Extensive repairs to the older portions of the piers are necessary, however.

With funds now available it is proposed to build about 600 linear feet of pile pier to replace a like amount of the inshore portions of the present piers, for reasons set forth in Annual Report for 1903, page 1861. Of this amount, 350 feet will be in the north pier and 250 feet in the south pier. The work will be done by hire of labor and use of United States dredging and pile-driving plants.

On the completion of this work there will be about 500 linear feet of the south pier to be rebuilt, and for which there are no funds available. It is important that this work should be done in the near future, as the old pier is in a very dilapidated condition.

The following estimate for maintenance of channel and existing works for the fiscal year ending June 30, 1907, is submitted:

For removing 500 feet of old crib pier and building pile pier in place thereof, at $40 per foot	$20,000
For dredging 30,000 cubic yards, at 15 cents	4,500
For minor repairs to piers and breakwater	2,500
For contingencies and superintendence	3,000
Total	30,000

Money statement.

July 1, 1904, balance unexpended		$19,451.81
Amount appropriated by river and harbor act approved March 3, 1905		30,000.00
Amount allotted from appropriation for maintenance of river and harbor improvements, act of April 28, 1904		6,284.67
		55,736.48
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$736.60	
For maintenance of improvement	4,951.96	
		5,688.56
July 1, 1905, balance unexpended		50,047.92
July 1, 1905, outstanding liabilities		19,709.28
July 1, 1905, balance available		30,338.64
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905		30,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

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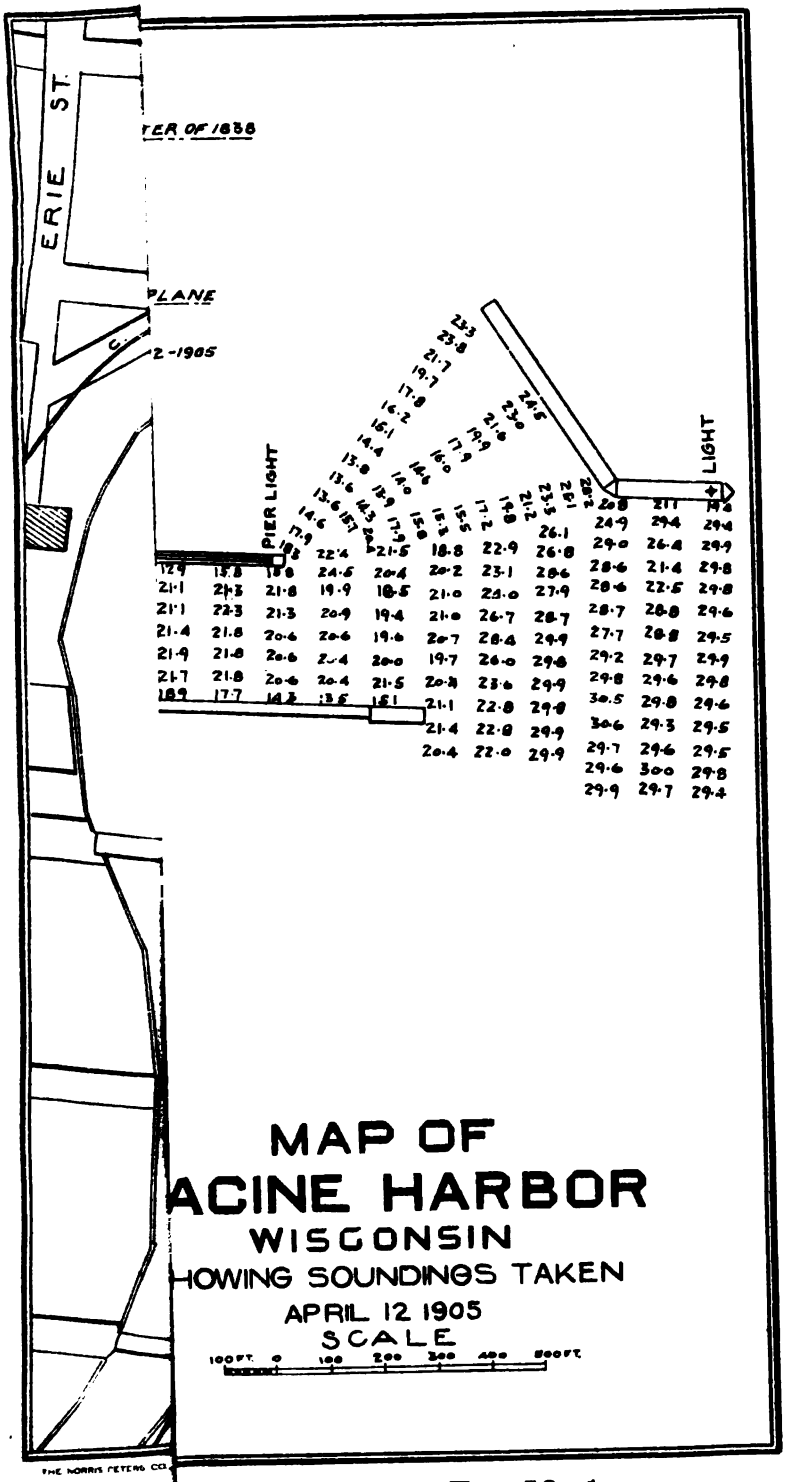

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APPROPRIATIONS.

June 15, 1844	$12,500.00	August 5, 1886	$10,000.00
August 30, 1852	10,000.00	August 11, 1888	10,000.00
June 28, 1864	3,600.00	September 19, 1890	17,500.00
June 23, 1866	23,910.00	July 13, 1892	25,000.00
March 2, 1867	45,000.00	August 18, 1894	20,000.00
April 10, 1869 (allotted)	22,275.00	June 3, 1896	27,000.00
July 11, 1870	10,000.00	March 3, 1899	50,000.00
March 3, 1871	10,000.00	June 6, 1900	67,650.00
March 3, 1873	20,000.00	June 13, 1902	20,000.00
June 23, 1874	10,000.00	April 28, 1904 (allotment from emergencies, river and harbor)	6,284.67
March 3, 1875	10,000.00	March 3, 1905	30,000.00
August 14, 1876	8,000.00	Miscellaneous receipts credited to appropriations	364.80
June 18, 1878	10,000.00	Total	511,084.47
March 3, 1879	6,000.00		
June 14, 1880	6,000.00		
March 3, 1881	6,000.00		
August 2, 1882	7,000.00		
July 5, 1884	7,000.00		

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR ENDING DECEMBER 31, 1904.

[Furnished by Mr. Peter B. Nelson, mayor of Racine, Wis.]

Arrivals and departures of vessels.

Description.	Arrivals.	Departures.
Steam	1,560	1,559
Sail	120	121
Total	1,680	1,680

By way of the harbor.

	Tons.
Exports	111,826
Imports	300,584
Total	412,410
Tonnage in calendar year ending December 31, 1903	444,773
Decrease	32,363

Principal articles of export.—Agricultural implements, brick, iron and steel, wagons and carriages, and general merchandise.

Principal articles of import.—Coal and coke, furniture, iron and steel, stone, wood, and general merchandise.

J J 18.

IMPROVEMENT OF KENOSHA HARBOR, WISCONSIN.

The original condition of the harbor and projects for its improvement are described, and references for more extended information and maps and for reports on examinations and surveys are given in Annual Report of the Chief of Engineers for 1903, page 487.

Operations during the fiscal year.—There were no operations other than taking soundings and preparation of maps incident to care and supervision.

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Condition of the improvement.—A bar with a least depth of 18.6 feet below datum over it extends entirely across the entrance to the harbor. Inside of the bar the channel is 21 feet deep below datum with a least width of 120 feet. Considerable shoaling has occurred in the basin, the depth over about one-half its area being from 18 to 19 feet below datum.

Remarks.—The piers and breakwater are in good condition and will require only minor repairs. Considerable dredging is needed to restore the projected depths of channel and basin.

The present project provides for taking up and resetting one or two cribs at the southerly end of the breakwater; but a Board of Engineers having been created by the act of March 3, 1905, to inquire into the effect of wave action as injuriously affecting this harbor, nothing has been done in furtherance of this project pending the action of said Board.

The funds available are sufficient for the maintenance of this harbor until June 30, 1907; therefore no estimate is submitted at this time.

Money statement.

July 1, 1904, balance unexpended	$17,475.00
Amount appropriated by river and harbor act approved March 3, 1905	5,000.00
	22,475.00
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	502.00
July 1, 1905, balance unexpended	21,973.00

APPROPRIATIONS.

March 15, 1844	$12,500.00	July 5, 1884	$5,000.00
March 3, 1845	15,000.00	August 5, 1886	5,000.00
August 13, 1852	10,000.00	August 11, 1888	7,500.00
June 23, 1866	75,461.41	September 19, 1890	17,500.00
April 10, 1869 (allotted)	5,346.00	July 13, 1892	15,000.00
July 11, 1870	10,000.00	August 18, 1894	15,000.00
March 3, 1871	10,000.00	June 3, 1896	24,000.00
June 10, 1872	10,000.00	March 3, 1899	50,000.00
June 23, 1874	10,000.00	June 6, 1900	135,000.00
March 3, 1875	15,000.00	June 13, 1902	5,000.00
August 14, 1876	8,000.00	March 3, 1905	5,000.00
June 18, 1878	8,000.00	Miscellaneous receipts credited to appropriation	157.71
March 3, 1879	5,000.00		
June 14, 1880	5,000.00		
March 3, 1881	5,000.00	Total	494,465.12
August 2, 1882	6,000.00		

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR ENDING DECEMBER 31, 1904.

[Furnished by Mr. William H. Devos, collector of customs, Milwaukee, Wis.]

Arrivals and departures of vessels.

Description.	Arrivals.	Departures.
Steam and sail	305	308

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By way of the harbor.

	Tons.
Exports	2,057
Imports	43,934
Total	45,991

Principal articles of export.—Sand and general merchandise.
Principal articles of import.—Coal, lumber, tan bark, and general merchandise.

J J 19.

IMPROVEMENT OF WAUKEGAN HARBOR, ILLINOIS.

The original condition of the harbor and project for its improvement are described, and references for more extended information and for report on examinations and surveys are given in Annual Report of the Chief of Engineers for 1903, page 488.

Operations during the fiscal year.—Work under the contract with the Hausler & Lutz Towing and Dock Company, for crib pier extension and breakwater, was completed December 30, 1904, and the contract closed. Under this contract the north pier was extended 1,000 feet, the south pier 1,400 feet, and a breakwater 588 feet long and 30 feet wide was built, all being provided with timber superstructures about 5 feet high above datum. During the fiscal year the south pier was extended 800 feet, the breakwater built, and both pier extensions and the breakwater provided with timber superstructure. The total cost of the work under this contract was $246,502.30, exclusive of the cost of superintendence and inspection; of this amount, $180,288.28 was expended during the fiscal year.

Total cost of breakwater	$51,990.48
Total cost of pier extensions	194,511.82
Total	246,502.30

Work under the contract with the Lydon & Drews Company, for pile revetment, removing old pier, and dredging was completed December 30, 1904, and the contract closed. Under this contract 1,097 linear feet of the old north pier was removed, 882 linear feet of sheet pile revetment was built, and the channel and basin dredged to a depth of 20 feet below datum, the amount of material dredged being 280,900 cubic yards of sand, mud, etc., at 9 cents per cubic yard, and 20,216 cubic yards of hardpan and bowlders, at 25 cents per cubic yard. The total cost of the work under this contract was $49,796.46, exclusive of the cost of superintendence and inspection; of this amount, $48,539.65 was expended during the fiscal year, as follows:

Pile revetment	$12,421.46
Removing old pier	7,040.00
Dredging	29,078.19
Total	48,539.65

Condition of the improvement.—The channel between the piers and in the basin has a depth of 20 feet below datum; the minimum width of this channel is 150 feet. There is, however, a bar in mid-channel

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at the harbor entrance with a minimum depth over it of 18.2 feet, and there are several small shoals in the entrance channel and basin with less than the required depth of 20 feet.

Remarks.—With the exception of repairs to the older portions of the piers, the present project is now completed.

On May 16 proposals for removing portions of the old piers and for building pile piers and timber superstructure were opened. Only three bids were received, the lowest one aggregating $68,400.56. This being greatly in excess of the amount available for the work, which is $55,000, and it having been demonstrated that the work probably could be done by hire of labor for the amount available, all bids were rejected. The work accordingly will be done by hire of labor, purchase of materials, and use of the Government dredging and pile-driving plants.

It is believed that the funds available are sufficient for rebuilding and repairing the piers and for maintenance of the channel and basin until June 30, 1907. Therefore no estimate is submitted.

Money statement.

July 1, 1904, balance unexpended	$270,156.49
Amount appropriated by river and harbor act approved March 3, 1905	30,000.00
Miscellaneous receipts	.14
	300,156.63
June 30, 1905, amount expended during fiscal year, for works of improvement	233,940.29
July 1, 1905, balance unexpended	66,216.34

APPROPRIATIONS.

August 30, 1852, for breakwater (outer)	$15,000.00	April 28, 1904	$5,000.00
June 14, 1880	15,000.00	March 3, 1905	30,000.00
March 3, 1881	15,000.00	Total appropriation for harbor	610,000.00
August 2, 1882	20,000.00	Appropriation for outer breakwater (1852)	15,000.00
July 5, 1884	20,000.00		595,500.00
August 15, 1886	20,000.00	Miscellaneous receipts credited to appropriations	.14
August 11, 1888	25,000.00		
September 19, 1890	35,000.00	Total for present harbor	595,500.14
July 13, 1892	25,000.00		
August 18, 1894	20,000.00		
June 3, 1896	20,000.00		
March 3, 1899	5,500.00		
June 13, 1902	100,000.00		
March 3, 1903	240,000.00		

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR ENDING DECEMBER 31, 1904.

[Furnished by Mr. W. W. Pearce, mayor of Waukegan, Ill.]

Arrivals and departures of vessels.

Description.	Arrivals.	Departures.
Steam	156	155
Sail	16	16
Total	172	171

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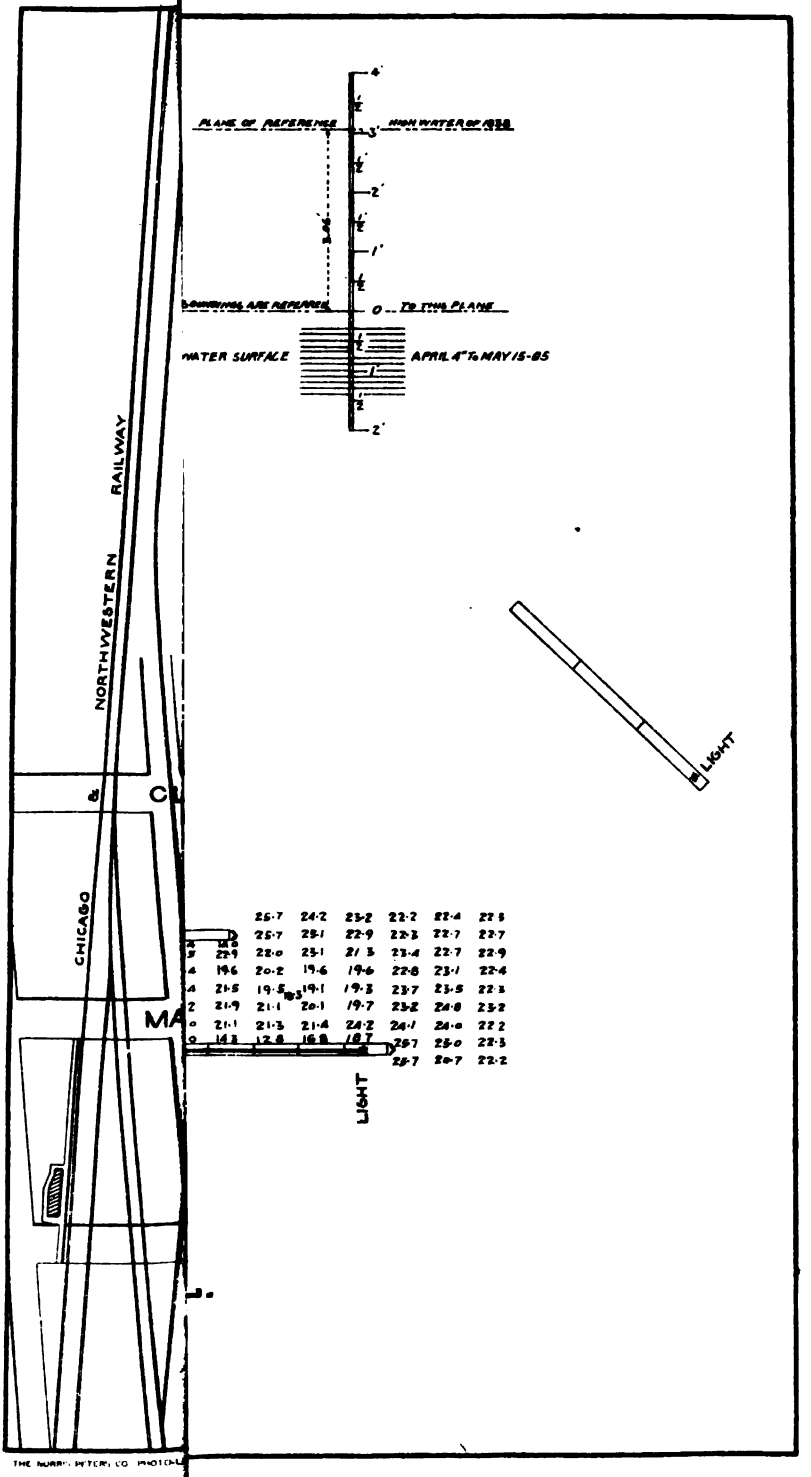

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By way of the harbor.

	Tons.
Exports	8,330
Imports	212,061
Total	220,391
Tonnage in calendar year ending December 31, 1903	160,037
Increase in 1904	60,354

Principal articles of export.—Coal, fish, lumber, and general merchandise.
Principal articles of import.—Coal, lumber, stone, and general merchandise.

J J 20.

IMPROVEMENT OF FOX RIVER, WISCONSIN.

The original condition, object of the improvement, projects, etc., are fully described in Annual Report of the Chief of Engineers for 1898, page 2339, and 1902, page 2077.

Attention is invited to the report upon "Operating and care of locks and dams on Fox River, Wisconsin."

During the fiscal year ending June 30, 1905, navigation closed December 1, 1904, and reopened April 10, 1905.

Operations during the fiscal year.—The operations during the year consisted in the partial construction of an elevator dredge and in dredging channel of upper Fox River.

For details, see accompanying report of Mr. L. M. Mann, assistant engineer.

Remarks and recommendations.—The approved project provides for widening and deepening channel of the Fox River from Green Bay to Montello, 100 feet wide and 6 feet deep, and from Montello to Portage, 100 feet wide and 4 feet deep, at mean low water.

Attention is respectfully invited to my report of last year on the matter of the further maintaining of the levee at Portage, Wis. (See Annual Report of the Chief of Engineers for 1904, pp. 2846–2848.)

Since the date of that report the State of Wisconsin, by its levee commission, has, under the authority of the Secretary of War, raised and strengthened the levee and has also joined two points of the same by a new embankment, on a rght of way purchased for the purpose, in rear of the United States levee, and making the corresponding portion of the latter unnecessary. The canal connecting the Fox and Wisconsin rivers, which, as stated in the report above referred to, with its two locks, is the only Government work in any way liable to damage by the flood from the Wisconsin River, is now in bad condition; its timber revetments are rotten; the channel is filling with sewage and material washed or thrown in from the banks, and the banks themselves; the United States right of way is so fully occupied by abutting owners that it has been impossible to repair the revetment without danger of arrest for trespass, as happened in 1897. It is my opinion that there is no general commerce of the United States or any interest of navigation which should be considered which will be benefited by a further expenditure of

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Federal money in that locality, and I have therefore to renew the recommendation made a year ago.

Money statement.

July 1, 1904, balance unexpended	$70,621.12
Amount appropriated by river and harbor act approved March 3, 1905	35,000.00
	105,621.12
June 30, 1905, amount expended during fiscal year, for works of improvement	5,234.60
July 1, 1905, balance unexpended	100,386.52
July 1, 1905, outstanding liabilities	372.00
July 1, 1905, balance available	100,014.52
July 1, 1905, amount covered by uncompleted contracts	39,000.00
Amount (estimated) required for completion of existing project	110,866.48
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	50,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

APPROPRIATIONS.

March 2, 1867, for snag boat on Wisconsin River	$40,000.00
July 10, 1870, for improving Wisconsin River	100,000.00
June 10, 1872, for purchase of works on Fox River from Green Bay and Mississippi Canal Company	145,000.00
March 3, 1873, for improving Fox and Wisconsin rivers	300,000.00
June 23, 1874	300,000.00
March 3, 1875	500,000.00
August 14, 1876	270,000.00
June 18, 1878	250,000.00
March 3, 1879	150,000.00
June 14, 1880	125,000.00
March 3, 1881	125,000.00
August 2, 1882	200,000.00
July 5, 1884	160,000.00
August 5, 1886, for improving Fox River	56,250.00
August 11, 1888, for improving Fox River	100,000.00
September 19, 1890, for improving Fox River	100,000.00
July 13, 1892, for improving Fox River	75,000.00
August 18, 1894, for improving Fox River	37,500.00
June 3, 1896, for improving Fox River	37,500.00
March 3, 1899, for improving Fox River	27,500.00
June 13, 1902	70,000.00
March 3, 1905	35,000.00
Miscellaneous receipts credited to appropriations	7,777.85
Total	3,211,527.85

CONTRACT IN FORCE.

For building an elevator dredge with auxiliary conveyor, complete, delivered on Fox River, $39,000.

Name of contractor: The Bucyrus Company.
Date of contract: May 6, 1904.
Date of approval: June 1, 1904.
Date of commencement: June 24, 1904.
Date for completion: May 1, 1905; time for completion of contract waived.

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COMMERCIAL STATISTICS.

List of articles transported on Fox River, Wisconsin, during the season of 1904.

Articles.	Quantity.	Articles.	Quantity.
	Tons.		*Tons.*
Apples	37.50	Lumber	6,061.25
Beer	53.50	Matches	75.00
Brick	11,199.50	Paper	217.75
Barley	1,555.00	Posts, cedar	12.00
Cement	214.00	Pulp wood	38,636.50
Coal	43,046.50	Railroad ties	30.00
Cord wood	18,964.00	Salt	1,096.50
Draintile	370.50	Sand and gravel	4,008.00
Flour, grain, and mill stuffs	2,142.00	Stone	3,388.00
General merchandise	8,036.50	Straw	89.00
Hardware	100.00	Sugar	70.00
Hay	1,018.00	Stave bolts	200.00
Horses	6.50	Slab wood	406.50
Lath and shingles	989.50		
Lime	406.25	Total	281,352.75
Logs	148,943.50		

Passengers, 43,276.

List of boats navigating Fox River between Portage and Green Bay, Wis., 1904.

Name of boat.	Draft.	Gross tonnage.	Class.
	′ ″		
Thistle	3 4	127	Steamer.
Le Fevre	3 0	138	Do.
Fashion	3 6	149	Do.
B. F. Carter	4 0	210	Do.
J. H. Marston	5 0	117	Do.
Evelyn	3 0	150	Do.
J. E. Leimer	1 8	139	Do.
Albatross	2 3	87	Do.
Belle	3 0	90	Do.
Fannie C. Hart	12 0	476	Between Green Bay and Depere only.
Eugene C. Hart	10 0	522	Do.
Harriet A. Hart	11 0	554	Do.
Birkhead	12 0	(a)	Do.
Sparta	13 0	(a)	Do.
Pawnee	14 0	(a)	Do.
Thew	12 0	(a)	Do.
George King	(a)	(a)	Do.
John Denessen	6 0	39	Steam tug.
Volunteer	6 0	34	Do.
Erna	6 6	14	Do.
M. D. Moore	3 0	59	Do.
S. W. Hollister	3 0	49	Do.
Boscobel	2 8	76	Do.
H. O. Warren	5 6	26	Do.
Jessie	4 0	16	Do.
Lucy F	3 0	10	Gasoline yacht.
Okoboji	4 6	15	Steam yacht.
Anna M	2 6	92	Do.
Cambria	4 0	48	Do.
Irma	3 6	30	Do.
Nia	3 6	45	Do.
Swallow	3 6	37	Do.
May Flower	3 0	49	Do.
Number 1	4 0	81	Tow scow.
Number 2	4 0	114	Do.
Long Tom	5 6	210	Do.
Bray	5 6	210	Do.
Taylor	5 6	200	Do.
Morrison	5 6	250	Do.
Pelton	5 6	204	Do.
Georgia	6 0	82	Sailing scow.

(a) Not known.

NOTE.—There are also a large number of small pleasure boats, both steam and gosoline, besides those mentioned.

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Number of lockages on Fox River, Wisconsin, for the calendar year 1904.

No.	Lock.	Lockages.	No.	Lock.	Lockages.
1	Depere	1,089	16	Appleton second	432
2	Little Kaukauna	695	17	Appleton first	582
3	Rapide Croche	511	18	Menasha	986
4	Kaukauna fifth	602	19	Eureka	917
5	Kaukauna fourth	599	20	Berlin	384
6	Kaukauna third	600	21	White River	178
7	Kaukauna second	612	22	Princeton	189
8	Kaukauna first	609	23	Grand River	212
9	Little Chute fourth[a]	568	24	Montello	84
10	Little Chute third[a]	569	25	Governor Bend	200
11	Little Chute second	561	26	Fort Winnebago	267
12	Little Chute first	563	27	Portage	90
13	Cedars	631			
14	Appleton fourth	595		Total	13,707
15	Appleton third	430			

[a] Combined.

NOTE.—The lockages for the calendar years 1903 and 1904 greatly exceed any previous record. Since the opening of navigation in 1905 there have been 4,618 lockages, being an increase of 40 per cent over same period in 1904, which indicates a constant and rapid increase of traffic.

REPORT OF MR. L. M. MANN, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
FOX RIVER IMPROVEMENT,
Oshkosh, Wis., June 30, 1905.

MAJOR: I have the honor to submit the following report of operations on "Improving Fox River, Wisconsin," from Portage to Green Bay, for the fiscal year ending June 30, 1905.

The work accomplished during the year consisted in commencing the construction of elevator dredge and auxiliary scows and in dredging upper Fox River.

ELEVATOR DREDGE.

In accordance with the contract of the Bucyrus Company, dated May 6, 1904, the detail plans and specifications for this dredge were prepared by the contractors and approved by the district officer April 1, 1905.

Work on construction of the hulls was commenced immediately at Green Bay and has been prosecuted diligently, except for unavoidable delays on account of the inability of the contractor to get the long timber delivered. April 26, 1905, the time for completion of contract was waived.

The hull of the dredge was framed, the parts assembled and bolted; the seams were calked and the hull painted. On June 24 the dredge was launched. The conveyor on dredge was framed and the winch machinery and centrifugal pump installed; the work of framing the house was commenced. The hulls of delivery scow and intermediate scow *No. 1* were partly framed and bolted.

DREDGING UPPER FOX RIVER.

In accordance with the general project, dredging was continued for providing a channel 100 feet wide and 6 feet deep at mean low water. At the close of the last fiscal year the channel had been completed from Princeton lock to a point 3,200 feet below milepost No. 51.

The work was continued downstream by dredge *No. 5* from July 1 to August 2, when she was withdrawn to work under operating and care, etc. Dredge *No. 4* commenced an July 21 and continued until November 3, when she was withdrawn to be laid up for the winter. On May 4, 1905, work was resumed at the above point by dredge *No. 5* and continued until May 17, when she was withdrawn and assigned to work under operating and care, etc. Dredge *No. 4* commenced on May 2 and has continued to the close of the fiscal year, completing the channel to a point 3,350 feet below milepost 47, where the dredge is now working.

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The improved channel, with 6 feet available depth at mean low water, is completed in accordance with the project from Green Bay to a point 300 feet above milepost No. 43 (White River lock). From White River lock to Montello the available depth is 4 feet at mean low water, although for a distance of 5.93 miles below Princeton lock the 6-foot channel is completed, but not available until it is completed to White River lock (3.3 miles). From Montello to Portage, the head of navigation of Fox River, the available depth is 3 feet at mean low water.

On the Wolf River, a channel 4 feet deep at mean low water extends to New London, above which place no work has been done, and is practically the head of navigation now. A summary of the work done is shown in the accompanying tabulation of dredging.

Tabulation of dredging.

Location.	Summary of cuts.			Material (dipper measurement).		Character of material dredged.	No. of dredge working.
	Length.	Average width.	Average depth.	Handled.	Rehandled.		
	Feet.	*Feet.*	*Feet.*	*Cu. yds.*	*Cu. yds.*		
From m. p. 50 to 51	3,550	45–60	2–7	23,270	1,890	Sand	5
From m. p. 49 to 50	6,620	15–40	½–3	17,238	5,520	Sand and clay	4
Do	260	60	2–3	2,200		Soft sand	5
From m. p. 48 to 49	5,320	15–40	½–4	14,028	1,480	Sand, clay, and gravel.	4
From m. p. 47 to 48	11,480	15–40	½–4	40,838	9,566	Sand, stone, clay, and gravel.	4
Do	350	65	1–3	3,000		do	5
From m. p. 46 to 47	630	60	1–3	5,760		Sand and gravel	5
Do	7,325	20–35	½–3	24,140	4,360	Sand	4
Total	35,535			130,474	22,816		

The total amount of dredging done during the fiscal year was 130,474 cubic yards, dipper measurement, at a cost of about 4 cents per cubic yard.

Respectfully submitted.

L. M. MANN, *Assistant Engineer.*

Maj. JAMES G. WARREN,
Corps of Engineers.

J J 21.

OPERATING AND CARE OF LOCKS AND DAMS ON FOX RIVER, WISCONSIN.

Under an allotment from the indefinite appropriation for operating and care of canals and other works of navigation there has been expended during the year ending June 30, 1905, the sum of $46,427.20.

The principal work has been dredging bars and channels, making repairs of locks, dams, canal banks, lock houses, dredges, and boats; rebuilding lower gates of Depere lock; repairs of and raising lower wing cribs of Little Kaukauna and Rapide Croche locks; repairs of Kaukauna third and fourth and Little Chute combined locks; repairing the crest of Appleton upper dam with concrete and replacing wooden sluice gates with new steel gates; repairs of Eureka lock and dam, and of Princeton lock.

For details of work done during the year, see report of Mr. L. M. Mann, assistant engineer, appended to this report.

It is again particularly to be noted that the continued enforcement of the rules and regulations for the navigation and use of the locks and canals on Fox River, approved by the Secretary of War, under the river and harbor act of August 18, 1894, amended by act of

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June 13, 1902, has brought about a general condition which is far more satisfactory than ever before to all interests concerned.

A revocable license, dated July 10, 1899, was granted by the Secretary of War, permitting the Neenah and Menasha Water Power Company to place 8-inch flushboards on the Menasha dam on conditions previously agreed to by the company in writing. Flushboards were placed on the dam by the company from July 25 to October 18, 1904, and from November 14, 1904, to February 23, 1905, when removed and not replaced to date.

An itemized statement of the expenditures during the year, required by section 4, river and harbor act of July 5, 1884, is appended hereto.

Money statement.

July 1, 1904, balance unexpended	$22,949.26
Miscellaneous receipts	32.17
Amount allotted for fiscal year ending June 30, 1905	31,117.60
	54,099.03
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	46,427.20
July 1, 1905, balance unexpended	7,671.83
July 1, 1905, outstanding liabilities	5,000.00
July 1, 1905, balance available	2,671.83
Amount allotted for expenditure in fiscal year ending June 30, 1906	53,604.16
Amount available for fiscal year ending June 30, 1906	56,275.99

List of allotments from appropriation for operating and care of canals and other works of navigation (indefinite), act of July 5, 1884, applied to Fox River, Wisconsin.

August 9, 1884	$54,000.00	October 4, 1898	$3,000.00
July 28, 1885	42,304.00	July 22, 1899	72,911.29
July 20, 1886	43,668.00	January 6, 1900	2,000.00
July 13, 1887	43,650.00	May 29, 1900	6,362.54
June 28, 1888	48,900.00	July 20, 1900	78,167.11
June 12, 1889	62,760.00	August 10, 1900	6,238.40
November 25, 1889	13,500.00	July 19, 1901	54,563.57
June 19, 1890	69,005.00	July 21, 1902	68,397.51
April 28, 1891	63,980.00	October 4, 1902	2,750.00
July 1, 1892	40,000.00	July 18, 1903	48,776.32
July 15, 1893	32,430.55	July 8, 1904	31,117.60
July 26, 1894	30,882.37	Miscellaneous receipts credited to appropriations	229.62
July 20, 1895	61,279.63		
October 6, 1896	62,665.03		
July 30, 1897	60,009.62		
July 29, 1898	63,869.10	Total	1,167,417.26

Summary of expenditures made from appropriation for operating and care of canals and other works of navigation (indefinite), act of July 5, 1884, applied to Fox River, Wisconsin, during the fiscal year ending June 30, 1905.

Services	$32,566.39
Supplies	1,894.57
Materials	11,083.01
Miscellaneous	883.23
Total	46,427.20

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REPORT OF MR. L. M. MANN, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
FOX RIVER IMPROVEMENT.
Oshkosh, Wis., June 30, 1905.

MAJOR: I have the honor to submit the following report of operations upon "Operating and care of canals and other works of navigation on Fox River, Wisconsin," from Green Bay to Portage, for the fiscal year ending June 30, 1905.

The work done during the year consisted principally in rebuilding the lower gates of DePere lock; building new tripod platforms of concrete at Rapide Croche, Kaukauna fourth, Kaukauna third, Little Chute Combined, Appleton third, second, and first locks; rebuilding the timber revetments on the two upper wing cribs and raising the lower wing cribs of Little Kaukauna lock; raising the lower wing cribs of Rapide Croche lock with cement masonry; repairing the crest of Appleton Upper dam with concrete and replacing three of the wooden sluice gates with new steel gates; repointing the abutments of Berlin, Eureka, and White River dams; repairing the upper platform and floor and repointing the masonry walls of Princeton lock; repairing the gates of Fort Winnebago lock; making slight repairs to DePere, Little Kaukauna, Rapide Croche, Kaukauna fourth, Kaukauna third, Little Chute second, Appleton fourth, Appleton first, Eureka, Berlin, White River, and Montello locks; Little Kaukauna, Rapide Croche, Little Chute, Appleton Upper, Menasha, Berlin, White River, and Montello dams; Rapide Croche, Kaukauna Second, Appleton Fourth, Eureka, White River, and Princeton lock houses; special and general repairs to boats and dredges; dredging bars and channels; general repairs to locks, dams, and canal banks, and care of works and property.

MAINTENANCE OF NAVIGATION.

Navigation was formally closed on the Fox and Wolf rivers December 1, 1904. It was again opened April 10, 1905. Princeton lock was closed for repairs from September 29 to October 10, 1904.

The water in the Lower Fox River and Lake Winnebago has been well maintained at the crest of the dams throughout the year, and no arrests for infringement of Rule 12 of the regulations, etc., were necessary.

The stage in Lake Winnebago for the fiscal year 1904–5 was below the crest of Menasha dam 105 days, 10 of which were during the season of navigation.

On October 27, 1904, the honorable the Secretary of War renewed the authority heretofore given to the Neenah and Menasha Water Power Company to draw the water 18 inches below the crest of Menasha dam during the suspension of navigation in 1904–5. The water carefully used and the lowest point reached was 16½ inches below the crest, on March 16, and it again reached the crest March 29.

The stages in Lake Winnebago were as follows:

Water below crest of Menasha dam ..... days	105
Water at or above crest of Menasha dam ..... do	260
Maximum height in 1905, June 10	+3.83
Maximum height in 1904, May 11	+3.42
Maximum height in 1903, April 10	+3.25
Maximum height in 1902, May 26	+3.28
Maximum height in 1901, April 13	+3.17
Maximum height in 1900, November 22	+2.87
Maximum height in 1899, May 15	+3.25
Lowest point reached, March 16, 1905	+0.37
Mean high water for twenty-three years	+3.02

The maximum discharge of the river during the year, measured at Rapide Croche dam, which gives practically the whole flow, was 924,939 cubic feet per minute on June 6, 1905, due largely to local rains on this date.

The mean monthly discharge at Rapide Croche dam, which corresponds closely to the discharge at Neenah and Manasha combined, for the year, is as follows:

1904.	Cu. ft. per min.
July	189,670
August	179,088
September	111,267
October	207,401
November	243,382
December	217,409

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1905.	Cu. ft. per min.
January	232,615
February	259,235
March	240,524
April	509,920
May	336,661
June	762,576
Mean for the year	290,812

The largest previous discharge was 739,034 cubic feet per minute on May 29, 1902, since measurements were had at this place.

Flush boards were placed on Menasha dam from July 25 to October 18, 1904, and from November 14, 1904, to February 23, 1905, inclusive, when they were removed and have not been replaced since. The mills were not obliged to close their wheels during the entire year, having an abundance of water, except from August 15 to September 20, 1904, when the water was drawn down above Appleton Upper dam to make repairs to the crest. The water in Lake Winnebago reached a stage requiring sluicing from April 8 to April 26, 1905, and June 6 to June 30, 1905.

Although the snow this year was exceedingly heavy and a large flood was anticipated, the month of March was very warm, causing the snow to disappear rapidly, and the rainfall in April was very low, being 1.62 inches below normal, and a flood, therefore, from April 8 to 26 was easily taken care of by sluicing, the water in Lake Winnebago only reaching +3′ 3″ on one day. The heavy rainfall in May, which was 3.02 inches above normal, kept the lake well up, and an extraordinary local rainfall of about 4 inches in forty-two hours brought on a second flood and necessitated sluicing, commencing on June 3. On June 6 all sluices in both the Neenah and Menasha dams were opened, but the water in Lake Winnebago continued to rise and reached a maximum stage of +3′ 10″. This is the highest stage since the spring of 1888, when it was +4′ 3″. This is the first time since the sluices in the dams were built that it has been impossible to hold the water down to sluicing limit, viz, 21 inches on the crest of Menasha dam. The rains being mainly local and unprecedented, the flood came on without any warning. Most of the water not local came from the Fox River, where the flood also was extraordinary. The Wolf River, generally furnishing the supply to Lake Winnebago, only has reached a normal high-water stage.

All sluices were continued open, and the capacity of all the sluices in both dams, both spillways, and the draft of the mills about held the flow of the river until June 18, when it commenced to fall, and dropped to 18 inches above the crest on June 30.

Gauge readings were calculated, tabulated, and platted, as were also the daily discharges of the river at different points, and record of rain gauges was kept.

NOTE.—The cause of the great June flood is shown directly in the discharge record above. The average daily discharge in the river for the month of June considerably exceeded the previous maximum discharge since measurements were taken in 1896.

REPAIRS OF LOCKS, ETC.

Depere lock.—The old lower gates were replaced with new gates of fir timber. New steel valves were placed and new ironwork, with the exception of part of the gate hangings and other minor parts, which were repaired and used on the new gates. The top arms of the upper gates and one intermediate arm of the upper right gate were renewed and other slight repairs were made. Repairs completed April 10, 1905.

Depere dam.—A hole in the canal bank at the right abutment, caused by high water, was filled with clay.

Little Kaukauna lock.—The decayed timber in the revetments on the upper wing cribs was replaced with new fir timber. The lower wing cribs were leveled up and raised 3 feet with hemlock timber and stone filling. Four holes in planking of lock walls were repaired and minor repairs were made. Repairs completed November 30, 1904.

Little Kaukauna dam.—Fir timber for repairs to the sluiceways, walk, and crest was purchased and received, but on account of high water the repairs could not be made.

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Little Kaukauna Canal bank.—The bank of the canal above the left revetment of lock was riprapped with stone for a distance of 150 linear feet.

Rapide Croche lock.—The lower wing cribs were removed to the water surface, decked over with old timber, and rebuilt with cement masonry, using stone removed from Appleton Upper dam; the wooden tripod platforms were replaced with tripod platforms of concrete, with steel cover plates, etc., and other minor repairs were made.

The upper left gate, displaced by a passing steamer in November, was repaired and replaced temporarily. At this time the upper gates were found to be badly decayed; they were therefore rebuilt of solid fir timber, with new ironwork, except a small amount on hand. In May, 1905, the old gates were removed and the new ones placed in position, completing the repairs May 10, 1905.

Rapide Croche dam.—A dry masonry wall was built at the lower end of right abutment to prevent water passing around same, the backing of earth was replaced, and slight repairs were made to trestle of sluiceway and to crest timber. Repairs completed May 10, 1905.

Kaukauna Fifth lock.—The lower left steel gate spar, which was damaged by a passing steamer, was replaced with an extra spar on hand and the damaged spar repaired. The outside of lock house and shed were painted. The tripod platforms were leveled up and the tripods and spars adjusted.

Kaukauna Fourth lock.—The old wooden tripod platforms were replaced with platforms of concrete with steel cover plates, etc. The canal bank on right above revetment wall was riprapped with stone for a distance of 250 feet. Other minor repairs were made to lock and banks.

Kaukauna Third lock.—The old wooden tripod platforms were replaced with platforms of concrete with steel cover plates, etc. New caps were placed on the maneuvering gear frames, the lower wing walls were repaired, and minor repairs made to wing walls, valves, etc.

Kaukauna dry dock.—An outhouse was built and placed near the lower left corner of the timber shed; the cement shed was put in good repair.

Kaukauna Second lock.—Slight repairs were made to the coping of the upper left wing wall, the tripod platforms were leveled up, and the tripods and spars adjusted.

Kaukauna Second lock house.—The walls and ceiling of the kitchen were plastered with adamant, 5 new windows were placed, and new baseboards were framed and placed in the kitchen.

Kaukauna First lock.—Valves and maneuvering gear were slightly repaired and adjusted.

Kaukauna First lock house.—The walls and ceiling of storeroom were sheathed on inside with 1 by 8 inch ship lap.

Kaukauna warehouse.—The side and end walls of the lean-to were painted outside.

Little Chute Combined locks.—The old wooden tripod platforms were replaced with platforms of concrete, with steel cover plates, etc. Valve-maneuvering gear, hand rails, and other minor repairs were made.

Little Chute Second lock.—The fender timber on lower right wing wall was renewed, and the top timbers of the crib below were renewed and replanked; a gas-pipe hand rail was placed on right side of right lock wall; other minor repairs were made.

Little Chute guard lock.—Slight repairs were made.

Little Chute dam.—The walk from left abutment to sluiceways and across sluiceway No. 1 was repaired.

Cedars lock.—Slight repairs were made to the valve-maneuvering gears.

Cedars Canal bank.—The dry wall on right bank of canal above lock for a distance of 80 linear feet was taken down and relaid.

Appleton Fourth lock.—The upper tripod platforms were repaired and other minor repairs were made.

Appleton Fourth lock house.—New floor of hard wood was laid in the sitting room.

Appleton Third lock.—The old wooden tripod platforms were replaced with platforms of concrete, with steel cover plates, etc. Other minor repairs were made. Repairs completed May 10, 1905.

Appleton Second lock.—The old wooden tripod platforms were replaced with platforms of concrete, with steel cover plates, etc., and other minor repairs were made.

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Appleton First lock.—The two wooden tripod platforms on the right side of the lock were replaced with platforms of concrete, with steel cover plates, etc., the footbridge over the lower end of the old lock was repaired and provided with gas-pipe hand rails; the triangular protection crib at the lower end of the lock was rebuilt above low water; minor repairs were made to the iron shed and coal bin and the road to the highway.

Appleton Upper dam.—The repairs to the dam consist in rebuilding the upper part of the dam with a solid section of concrete and in replacing three of the wooden Taintor sluice gates with gates made entirely of structural steel and iron. Material for repairs of crest was purchased during the last fiscal year, but owing to the high stage of water the work could not be undertaken. On August 1, 1904, the work of making these repairs was commenced. Tools and material on hand were collected at Appleton. The water in the level above was drawn down to 2½ feet below the crest on the 15th and the clay and gravel backing of the dam was removed from the masonry and thrown up in the form of a dike. The masonry of the dam was removed to an average depth of 3½ feet below the crest, the depth depending on the condition of the structure. The masonry was found in very bad condtion, large cavities, filled with small stone, clay, etc., and the mortar having been almost entirely disintegrated. All the cavities were cleaned out and filled with cement masonry, forming a firm foundation for the concrete, into which were set iron dowel pins to secure the same. The concrete was mixed on scows, moved along the dam, and placed by hand. Alpha Portland cement was used, the proportions being 1 part cement, 2 parts sand, and 5 parts crushed stone. The concrete was placed in sections about 16 feet in length, and was finished with a dressing of Portland-cement mortar. The work was completed September 15, 1905, and presents a very uniform crest, circular in form, and has proved itself to be a very important feature of repairs, as the past severe winter and the recent extreme high water has given it a severe test. Although built in sections, the new crest is practically a monolith, about 3½ feet high and 562 feet long. It is surprising that to date no cracks are apparent, either from contraction or otherwise.

On January 31, 1905, a contract was let to the Modern Steel Structural Company, of Waukesha, Wis., for five steel Taintor gates, three of which were to replace three wooden gates in this dam. These gates are constructed entirely of structural steel and iron, hinged to beams of same material, anchored to the stone abutments of the dam according to new plans. In May, 1905, these three gates were placed in position and are proving to be very satisfactory and a decided improvement over the wooden ones.

Menasha dam.—Slight repairs were made to the walk over sluiceways. The sluiceways which were damaged by logs passing through were repaired.

Menasha channel crib.—This crib, which had been tipped over by the ice, was straightened up and found to be in good condition.

Eureka lock.—The new upper gates, which were framed during the last fiscal year, were put together and provided with new steel valves, two in each gate, new shackle bars, valve rods, and gas-pipe hand rails; masonry was repointed; the right bank of canal above lock was riprapped for a distance of 107 linear feet. Four new guard piles were driven below lock.

Eureka dam.—Masonry of dam was repointed. Decayed tops of piles in shore protection on left side below dam were cut off.

Eureka lock house.—A new cistern was placed at lock house and connections made with eave troughs; new sills and floor were laid in the tool house; the road from lock to highway was raised and the small bridge in same was repaired.

Berlin lock.—Ten piles were driven along the left bank below lock for mooring the fleet while in winter quarters; four piles were driven and capped for dock in front of repair shop; the bank between shop and canal was graded; the bridge in canal bank below lock was raised and repaired; the road between lock and lock house was repaired. Slight repairs to iron shed were made and numerous tools were repaired.

Berlin lock house.—Slight repairs were made to the roof and the brick cistern was replastered with cement.

Berlin dam.—The masonry abutments of dam were repointed; two decayed piles above fishway were replaced.

White River lock.—The left bank below lock was graded and riprapped for a distance of 100 linear feet; two guard piles below the lock, which were raised by the ice, were redriven.

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White River lock house.—New hard-wood floors were laid in the kitchen and pantry; two chimneys were rebuilt above the roof; a new outhouse was built and vault enlarged and repaired; the road to highway was raised and repaired.

White River dam.—The masonry abutments were repointed; decayed piles in front of fishway were replaced.

Princeton lock.—The work of making repairs to miter sills and floor of this lock, which could not be done during the last fiscal year on account of the high stage of water, was commenced September 29, 1903, the water being then at a low stage. Stop timbers were placed in the head walls and a dike thrown up across the canal below the lock. A 10-inch centrifugal pump was set up and the water pumped out, and was easily kept out with this pump while making the repairs. The floor of the upper platform and the lock was cleaned and repaired; the miter sills, which were found to be sound, but waterworn, were trued and squared up with fir plank, after which the stop timbers were removed, the dike opened, and navigation resumed on October 10. Decayed timber in the tripod platforms was renewed and the platforms raised and leveled. Repairs completed November 5, 1904.

Princeton lock house.—A fence was built around the house, and the wire fence between the house and road was repaired, with new posts and wire; the platform back of house was rebuilt; slight repairs were made to brick walls and roof.

Grand River.—The flush boards in waste weir in mouth of Grand River were repaired.

Montello lock.—A tool house built at Berlin lock during the last fiscal year was transported to Montello lock and placed at the upper end of the lock opposite the left abutment of the dam; a fence was built around the United States property at the lock. Gates were provided at highway to enter grounds on either side, and also gates to close across highway. Other minor repairs were made.

Montello dam.—This dam was backed with gravel in May and June, 1905.

Governor Bend lock.—Slight repairs were made to the valve rods.

Fort Winnebago lock.—The upper part of the lower gates and the lower left hollow quoin being decayed were rebuilt above water surface with new fir timber; minor repairs were made to the ironwork.

SHORE PROTECTION ON UPPER FOX RIVER.

Sand bank below mile post 44.—The left bank of river from 500 to 1,060 feet below mile post 44 was protected with piles, brush, and stone; the material for which was purchased during the last fiscal year.

Sand bank above mile post 44.—Willows were planted along the bank near the water's edge to protect the bank at this place.

Repairs of shore protections.—The piles in the shore protections above Berlin and White River locks, which were left standing above water when protections were built, were cut off at low water and missing piles were replaced.

Grand River lock.—The right bank above the lock, which was broken by a freshet in April, was raised and repaired.

Grand River dam.—Decayed guard piles above sluiceway and in front of fishway were replaced with new piles.

DREDGING BARS AND CHANNELS.

To maintain a navigable channel and restore it to dimensions heretofore obtained, and in maintaining a channel where projected depth had not been obtained, bars were removed on the upper Fox River, as shown in the following tabulation:

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The following is a summary of the work done:

Location.	Summary of cuts.			Material (dipper measurement).		Character of material dredged.	No. of dredge working.
	Length.	Average width.	Average depth.	Handled.	Rehandled.		
	Feet.	*Feet.*	*Feet.*	*Cu. yds.*	*Cu. yds.*		
Bar at milepost 24	3,400	20-35	1-3	9,170	2,520	Sand	4
Bar above White River lock.	725	60-75	1-3	3,400	.....	do	5
Bar below milepost 46	700	60	1-3	6,465	.....	Sand and gravel	5
Bar above milepost 47	1,585	60	1-4	10,680	.....	Sand, clay, and stone.	5
At foot of Lake Apuckawa.	4,150	60	3-5	31,290	.....	Mud	5
At head of Lake Apuckawa.	800	60	3	4,460	.....	do	5
Bar below milepost 92	735	60	1-3	5,798	.....	Sand and gravel	5
Bar above milepost 92	480	60	2-4	3,720	.....	Hard sand	5
Bar above milepost 98	540	60	1-4	3,480	.....	Sand, clay, and stone.	5
Bar below milepost 99	1,565	60	1-3	7,090	.....	Mud, hardpan, and stone.	5
Total	14,680	.....	.....	85,553			

The total amount of dredging done during the fiscal year was 85,553 cubic yards, dipper measurement, at a cost of about 4 cents per cubic yard.

Repairs were made to mileposts on upper Fox River by redriving 7 old and driving 7 new piles; 5 new posts were set on bank; 13 new number boards were made and placed and 3 old boards were repainted.

SPECIAL REPAIRS TO PLANT.

Barge Princeton.—The grouser frames were renewed and material was purchased for new grousers.

Quarter boat.—The old tin roof was removed and a new tin roof placed by agreement. New outside doors and screens were purchased, fitted, and hung, and the casings, stops, and thresholds repaired. The deck seams were hawsed, calked, and pitched where necessary. The hull and cabin outside and the cabin inside were painted.

Flat scow Eureka.—Decayed timber in the deck beams and the decking, hatch coamings and covers was renewed with new fir timber and the deck seams calked and pitched.

GENERAL REPAIRS OF PLANT, BOATS, DREDGES, ETC.

Steam tug Fox.—In August, 1904, slight changes were made in the buckets of the paddle wheels to reduce the vibration while the boat was running. She was laid up at Berlin lock for the winter on November 22. In March and April, 1905, the old paddle wheels and shafts were removed and new and larger shafts were provided, with paddle wheels 13 feet 6 inches in diameter, containing 14 instead of 11 arms in each wheel. The buckets are arranged differently than the old ones, the combined bucket area corresponding to the power of the engines and the individual buckets corresponding in size and position on the wheel to the force exerted. The shafts were raised 4 inches to reduce the dip of the buckets. This change has greatly reduced the vibration and increased the speed of the boat. Slight repairs were made to the bulwarks. The necessary cleaning and painting was done and the tug placed in commission May 1, 1905.

Steam tug Wolf.—Was laid up for the winter at Berlin lock on November 18. In March and April, 1905, a new throttle valve was placed in the main steam pipe, with new reach rod and levers; the links and rocker shaft boxes were refitted; new canvas was placed on the roof of pilot house and officers' cabin; slight repairs were made to deck, and the necessary painting was done. She was placed in commission April 21, 1905.

Dredge No. 4.—Was laid up for the winter at Berlin lock November 17, 1904. In March and April, 1905, slight repairs were made to spud boxes, crane, dipper sheave, and dipper. She was put in commission on May 1, 1905.

Dredge No. 5.—Was laid up at Berlin lock for the winter on November 18, 1904. In March and April, 1905, the grapple was repaired by fitting renewable points to prongs, reinforcing the connecting rods, and repairing broken brackets.

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The broken gear wheel was replaced with a new gear wheel; new blocks were placed in the starboard friction, and other slight repairs were made. She was put in commission May 2, 1905.

Scow Eureka.—The forward spud frame was repaired and two new spuds were framed and placed.

Pile driver.—The old sheave casing was remodeled for new sheave.

Respectfully submitted.

L. M. MANN, *Assistant Engineer.*

Maj. JAMES G. WARREN,
Corps of Engineers.

OPERATING AND CARE OF CANALS AND OTHER WORKS OF NAVIGATION APPLIED TO FOX RIVER, WISCONSIN.

[Section 4 of river and harbor act of July 5, 1884.]

Detailed statement of expenditures for fiscal year ending June 30, 1905.

Character of works, etc.	Item of expense.	Amount.	Total.
Repairs of Depere lock	Material	$685.56	
Do	Labor and transportation.	516.69	
			$1,202.25
Repairs of Little Kaukauna lock	Material	248.12	
Do	Labor and transportation.	111.07	
			359.19
Repairs of Little Kaukauna dam	Material	99.90	
Do	Labor and transportation.	14.21	
			114.11
Repairs of Little Kaukauna Canal bank	do		85.67
Repairs of Rapide Croche lock	Material	445.26	
Do	Labor and transportation.	867.91	
			1,313.17
Repairs of Rapide Croche dam	Material	8.97	
Do	Labor and transportation.	104.66	
			113.63
Repairs of Kaukauna fourth lock	Material	256.16	
Do	Labor and transportation.	170.90	
			427.06
Repairs of Kaukauna third lock	Material	252.24	
Do	Labor and transportation.	220.31	
			472.55
Repairs of Kaukauna dry dock	Material	10.40	
Do	Labor and transportation.	8.25	
			18.65
Repairs of Kaukauna second lock house	Material		34.44
Repairs of Little Chute combined locks	do	375.85	
Do	Labor and transportation.	292.37	
			667.72
Repairs of Little Chute second lock	Material	107.53	
Do	Labor and transportation.	91.29	
			198.82
Repairs of Little Chute dam	Material	119.06	
Do	Labor and transportation.	53.91	
			172.97
Repairs of Cedars Canal bank	Labor		25.88
Repairs of Appleton fourth lock and lock house	Material	18.76	
Do	Labor and transportation.	29.93	
			48.69
Repairs of Appleton third lock	Material	263.11	
Do	Labor and transportation.	164.85	
			427.96
Repairs of Appleton second lock	Material	252.21	
Do	Labor and transportation.	157.01	
			409.22
Repairs of Appleton first lock	Material	206.02	
Do	Labor and transportation.	180.35	
			386.37
Repairs of Appleton upper dam	Material	78.35	
Do	Labor and transportation.	3,951.05	
			4,029.40
Repairs of Menasha dam	Material	38.01	
Do	Labor	47.50	
			85.51
Repairs of Menasha channel	do		19.33
Five steel taintor gates	Material and labor		2,837.95
Repairs of Eureka lock, lock house, and dam	Material	72.61	
Do	Labor	1,405.74	
			1,478.35
Repairs of Berlin lock and dam	Material	45.63	
Do	Labor	47.00	
			92.63

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Detailed statement of expenditures for fiscal year, etc.—Continued.

Character of works, etc.	Item of expense.	Amount.	Total.
Repairs of White River lock	Labor		
Repairs of White River dam	Material	99.11	
Do	Labor	11.50	
Repairs of White River lock house	Material	29.05	
Do	Labor	40.50	
Repairs of Princeton lock	Material	50.05	
Do	Labor and transportation	547.32	
Repairs of Princeton lock house	Material	91.00	
Do	Labor	39.50	
Repairs of Montello dam	Labor and transportation		
Repairs of Montello lock	Material	6.28	
Do	Labor and transportation	127.75	
Repairs of Port Winnebago lock	Material	102.12	
Do	Labor and transportation	44.00	
Protection of sand banks and shores, upper Fox River.	do		
Special repairs to plant	Repairs to scow Eureka	111.14	
Do	Repairs to barge Princeton.	31.02	
Do	Repairs to quarter boat No. 1.	130.69	
Do	Miscellaneous	109.69	
General repairs to plant, boats, dredges, machinery, etc.	Repairs of tug Fox	1,214.64	
Do	Repairs of tug Wolf	386.98	
Do	Repairs of dredge No. 5	286.73	
Do	Repairs of dredge No. 4	99.02	
Do	Repairs of scow Eureka	11.13	
Do	Miscellaneous	339.99	
General repairs to locks, dams, and canal banks	Material	1,681.81	
Do	Labor and transportation	3,457.99	
Dredging bars and channels	Fuel, supplies, etc.	332.76	
Do	Labor	1,532.75	
Care of works and property	Watchmen, labor, and transportation	1,941.35	
Do	Fuel for tugs Fox and Wolf	470.35	
Do	Traveling expenses of assistant engineers, etc.	170.45	
Do	Subsistence	5.92	
Do	Laundering bedding, etc., for tug Fox	1.68	
Do	Lighting	54.48	
Do	Telegrams	1.66	
Do	Repairs of typewriter	1.45	
Do	Stamps, paper for letterpress	1.75	
Do	Hardware for tugs	1.49	
Do	Awnings, sidewalk office	15.00	
Maintenance of navigation	Lock masters' services	1,351.49	
Do	Gauge observers' services	60.00	
Superintendence and engineering	Salary of assistant engineer	1,600.00	
Do	Salary of junior engineer	1,200.00	
Do	Salary of superintendent	1,400.00	
Do	Salary of clerk	1,000.00	
Do	Salary of messenger	720.00	
Do	Salary of laborers, etc.	1,145.14	
Do	Messenger [illegible]	30.51	
Do	Rental of telephones and [illegible]	122.15	
Do	Telegrams	2.25	
Do	Drayage	6.00	
Do	Rental of post-office box, [illegible]	3.00	
Do	Stationery, paper	3.70	
Do	Rent of office, sidewalk	375.00	
Do	Stationery	108.00	
Total			6,[illegible]

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J J 22.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

Wreck of sand scow Hiram R. Bond in Milwaukee Bay.—On May 29, 1905, during a fog, the steam sand scow *Hiram R. Bond* was sunk in collision with car ferry steamer *Pere Marquette No. 20*, in Milwaukee Bay, Wisconsin. The scow sunk in about 40 feet of water, at a point E. S. E. ½ E. and about five-eighths mile distant from the southerly end of the breakwater.

An examination showed that there was only 17½ feet of water over the wreck and that it was a dangerous obstruction to navigation.

The wreck was formally abandoned by its owners, the Milwaukee Sand and Gravel Company, by letter dated June 7, 1905, and a recommendation dated June 7, 1905, that an allotment of $2,000 be made from the permanent indefinite appropriation for removing sunken vessels or craft obstructing or endangering navigation, was approved June 12, 1905.

Proposals for removing the wreck were received June 12, 1905, from the following:

Independent Tug Company	$1,400
Andrew Petersen	1,200
Milwaukee Tugboat Line	1,300

An emergency contract was entered into with Mr. Andrew Petersen on June 12, 1905, for the removal of the wreck to a depth of 30 feet below datum.

The wreck was blown up and destroyed by dynamite. On June 30, 1905, the site of the wreck was carefully swept to a depth of 30 feet and no obstruction was encountered.

The cost of removing the wreck was $1,200.

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APPENDIX K K.

IMPROVEMENT OF CHICAGO AND CALUMET HARBORS AND CHICAGO RIVER, ILLINOIS, AND OF CALUMET RIVER, ILLINOIS AND INDIANA; SURVEY OF ILLINOIS AND DES PLAINES RIVERS, ILLINOIS, FOR WATERWAY FROM LOCKPORT, ILLINOIS, TO ST. LOUIS, MISSOURI.

REPORT FOR THE FISCAL YEAR ENDING JUNE 30, 1905, WITH OTHER DOCUMENTS RELATING TO THE WORKS. OFFICERS IN CHARGE: COL. O. H. ERNST AND LIEUT. COL. W. H. BIXBY, CORPS OF ENGINEERS.

IMPROVEMENTS.

1. Chicago Harbor, Illinois.
2. Chicago River, Illinois.
3. Calumet Harbor, Illinois.
4. Calumet River, Illinois and Indiana.
5. Survey of Illinois and Des Plaines rivers, Illinois, for waterway from Lockport, Illinois, to St. Louis, Missouri.

UNITED STATES ENGINEER OFFICE,
Chicago, Ill., July 2, 1905.

GENERAL: I have the honor to forward herewith the annual reports upon the works in my charge for the fiscal year ending June 30, 1905.

Very respectfully, your obedient servant,

W. H. BIXBY,
Lieut. Col., Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

K K 1.

IMPROVEMENT OF CHICAGO HARBOR, ILLINOIS.

Outer basin.—This basin originally covered 455 acres of the area of Lake Michigan, of which 270 acres lie lakeward or east of the dock line established by the Secretary of War September 22, 1890, and 185 acres shoreward or west of this dock line. The dock line is

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about 1,300 feet east of the right of way of the Illinois Central Railroad and 2,000 feet distant from and parallel to the easterly breakwater of the basin.

Under authority granted by the Secretary of War July 24, 1895, a bulkhead has been constructed along the dock line, and the area shoreward of the dock line is now being filled in by the city of Chicago for a public park. Of the 270 acres lakeward of the dock line, an area about 1,150 feet in width and 3,000 feet in length, extending southwardly from the river, and comprising about 79 acres, has been dredged to a depth of 21 feet below Chicago city datum. During the year irregular dredging has been done in this area by the park commissioners of the city of Chicago for the purpose of filling behind the dock line for the park.

The dredging so far done has resulted in a 21-foot depth over the channel in the river from Pine street to the lake and over the bar at the harbor entrance, as well as over the 79 acres of the basin mentioned above. Redredging will, of course, be necessary from time to time.

The piers and breakwaters, except the north pier, are generally in fair condition. Being constructed of wooden cribs, ballasted with stone, their superstructures must all, in course of time, be rebuilt, but for several years the repair work will be merely that due to unexpected accident, except the north pier. That pier has suffered from fire and collisions as well as decay, and its superstructure is to be replaced with concrete.

There was no contract in force during the year for the improvement of this harbor, and the only work done was the construction of a boathouse for the United States steam launch near the northerly end of the easterly breakwater.

Proposals for dredging in the outer basin were advertised for on June 23, to be opened July 25, 1905.

It is proposed to use the funds now available and those recommended for appropriation for the fiscal year ending June 30, 1906, in dredging the outer basin, in maintaining existing works, and in rebuilding the superstructure of the north pier in concrete.

Money statement.

July 1, 1904, balance unexpended		$1,674.55
Amount appropriated by river and harbor act approved March 3, 1905		200,000.00
Received from sale of property		15.30
		201,689.85
June 30, 1905, amount expended during fiscal year, for maintenance of improvement		1,058.61
July 1, 1905, balance unexpended		200,631.24
Amount (estimated) required for completion of existing project		294,960.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$294,960.00	
For maintenance of improvement	10,000.00	
		304,960.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

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LIST OF APPROPRIATIONS FOR HARBOR AT CHICAGO, ILL.

By act of—	
July 11, 1870	$100,000.00
March 3, 1871	100,000.00
June 10, 1872	90,000.00
March 3, 1873	90,000.00
June 23, 1874	75,000.00
March 3, 1875	78,000.00
August 3, 1876	5,000.00
June 18, 1878	75,000.00
March 3, 1879	75,000.00
June 14, 1880	145,000.00
March 3, 1881	150,000.00
August 2, 1882	200,000.00
July 5, 1884	100,000.00
August 5, 1886	75,000.00
August 11, 1888	200,000.00
September 19, 1890	100,000.00
July 13, 1892	72,000.00
By act of—	
August 18, 1894	$80,000.00
March 3, 1899	100,000.00
March 3, 1905	200,000.00
Total appropriated	2,110,000.00
Received from all sources since 1870 (transfer of tugs, sales, etc.)	936.46
Total	2,110,936.46
Expenditures to June 30, 1905	1,910,305.22
Balance unexpended June 30, 1905	200,631.24

COMMERCIAL STATISTICS.

Receipts and shipments by lake at Chicago during calendar year 1904.

Receipts.	Quantities.	Shipments.	Quantities.
	Tons.		*Tons.*
Coal	762,671	Wheat	110,133
Iron ore	15,182	Corn	689,888
Salt	195,615	Oats	80,874
Lumber	756,064	Rye	3,500
Shingles	2,693	Barley	6,840
Lath	1,176	Flaxseed	4,522
Posts	25,212	Flour	133,537
Ties	82,988	Cereals	7,052
Poles	17,523	Mill stuffs	43,159
Wood	12,009	Gluten meal	8,349
Plaster	8,220	Malt	5,749
Cement	55,083	Oil cake	7,430
Asphalt	4,031	Grass seed	530
Sulphur	1,129	Glucose	23,486
Copper	7,647	Sugar	4,502
Hides	27	Oil	854
Hardware	19,064	Pork	697
Shoes	18,404	Tallow	3,533
Sugar	221,746	Hides	110
Groceries	73,983	Wool and hair	3,196
Green fruits	194,103	Broom corn	156
Potatoes	5,410	Spelter	3,025
Coffee	8,597	Groceries	5,850
Grain	29,058	Iron	2,340
Unclassified	461,729	Unclassified	315,335
Total	2,981,424	Total	1,464,647

Comparison of receipts and shipments for years 1895 to 1904, inclusive.

Year.	Tons.	Year.	Tons.
1895	7,205,942	1900	5,873,070
1896	6,347,163	1901	6,184,242
1897	7,149,759	1902	5,184,792
1898	7,391,454	1903	6,105,553
1899	6,189,365	1904	4,446,071

Amount of revenue collected during fiscal year 1905 ..... $7,964,313.73

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Arrivals and clearances of vessels, Chicago Harbor, Illinois.

Vessels.	Arrivals.		Clearances.	
	Number.	Tons.	Number.	Tons.
Steam	5,568	4,786,756	5,479	4,609,645
Sail	493	171,320	499	174,484
Total	6,061	4,958,076	5,978	4,784,129

REPORT OF MR. G. A. M. LILJENCRANTZ, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Chicago, Ill., July 3, 1905.

COLONEL: I have the honor to submit the following report on operations in Chicago Harbor, Illinois, during the year ending June 30, 1905:

There was no contract in force during the year for any work of improvement of this harbor, and no such work was done.

WORK DONE DURING THE YEAR.

The only work done during the year was the construction of a boathouse for the U. S. steam launch *Dearborn*, near the northerly end of the easterly breakwater. This was authorized by the Chief of Engineers on September 22, 1904, at a cost not to exceed $2,700. The foundation for the boathouse was built under contract with the Fitzsimons & Connell Company, of Chicago, Ill., at a cost of $1,036.50. The other work was done by hired labor, and was sufficiently near completion in the month of December to have the launch hoisted up in it for the winter. The office having been moved to the new Federal building on the 17th of April, 1905, the boathouse at the foot of Sixteenth street, occupied under a lease with the Illinois Central Railroad Company, was vacated at the close of that month. The new house is practically completed, some minor parts only remaining to be added. The total cost up to date has been $2,496.52. A great deal of trouble was experienced with the boiler on the *Dearborn*, several leakages having occurred, necessitating rather extensive repairs and renewal of pipes.

By the river and harbor act of Congress, approved March 3, 1905, the sum of $200,000 was appropriated for the improvement of the harbor under the approved project. This contemplates the rebuilding of the superstructure over the north pier with concrete, and dredging to a depth of 21 feet below city datum, in the outer basin.

Specifications for the concrete work have not yet been prepared; those for dredging in the basin were approved by the Chief of Engineers on June 16, 1905. Proposals for this work were advertised for on the 23d of that month and will be opened on the 25th of the present month.

WORK PROPOSED FOR THE YEAR ENDING JUNE 30, 1906.

It is proposed to secure bids for and commence work on the concrete superstructure over the north pier; also to begin, and possibly complete, the dredging in the basin. The plan for this work is to continue the 1,150 feet wide channel along the easterly breakwater from the point—3,000 feet south of the river entrance—to where it was completed last year, and southwardly so as to secure a deep-channel connection with the lake through the southerly entrance to the basin, and then to widen this channel as far as can be done with available funds.

* * * * * * *

The Lake View intake crib, located about 10,000 feet due east from the foot of Montrose boulevard, is to have the part above the water level rebuilt by the city of Chicago with a stone and brick structure and a steel tower having a focal plane of 55.58 feet above city datum and provided with a fixed white light. The improvement is to be completed in October, 1905, and meantime a similar light, visible all around the horizon, will be placed on a pole at an altitude of about 30 feet above the water level.

I am, Colonel, very respectfully, your obedient servant,

G. A. M. LILJENCRANTZ,
Assistant Engineer.

Lieut. Col. W. H. BIXBY,
Corps of Engineers.

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K K 2.

IMPROVEMENT OF CHICAGO RIVER, ILLINOIS.

This river constitutes the inner harbor of Chicago, Ill. Its navigable parts lie wholly within the city limits of Chicago.

In the Annual Report of the Chief of Engineers for 1893, page 2974, may be found a full report upon this stream and its needed improvement, and in Annual Report for 1897, page 2793, a history of the improvement and some detailed information as to the obstructions to navigation existing along its channels. Reference is made in Report of 1902, page 2097, to the work undertaken by the sanitary district of Chicago in connection with the improvement of this river.

At the close of the fiscal year ending June 30, 1902, the project under the act of June 3, 1896, as modified by the act of June 4, 1897, for improvement by dredging to allow passage by vessels drawing 16 feet of water, and to cut away certain obstructive bends and projecting docks, had been completed.

The draft of vessels navigating the Chicago River is limited to about 16 feet, there being only about 17 feet of water over two of the tunnels under the river, and about 18 feet over the third.

Congress, by act approved April 27, 1904, declared these tunnels unreasonable obstructions to the free navigation of the river, and made it the duty of the Secretary of War to give notice to the persons or corporations owning or controlling them so to alter them as to render navigation over them free, easy, and unobstructed.

A public hearing was held May 18, 1904, and a report submitted May 26, 1904, by Col. O. H. Ernst, Corps of Engineers, which was published as War Department Document No. 227, and is printed herewith. The notices required by the act to be given by the Secretary of War were served on the various parties in interest September 30, 1904, as follows:

The city of Chicago, as owner of, and the Chicago Passenger Railway Company, as grantee of, the franchise to use the Washington street tunnel.

The city of Chicago, as owner of, and the North Chicago Street Railroad Company, as grantee of, the franchise to use the La Salle street tunnel.

The West Chicago Street Railroad Company, as owner of the tunnel near Van Buren street.

Notices were also served on the Chicago Union Traction Company, as assignee of lessee of the Chicago Passenger Railway Company, in respect to the Washington street tunnel; and lessee of the North Chicago Street Railroad Company, and of the West Chicago Street Railroad Company, in respect to the tunnels at La Salle street and near Van Buren street, to lower all three of these tunnels.

All of these notices required the tunnels to be altered so that there shall be a depth of water over them of at least 22 feet, and prescribed that the alterations shall be completed by April 15, 1906.

The tunnels are still in daily operation, and so far as known to this office the tunnel owners do not intend any action toward removal of the obstructions before the last month of their time limit.

At the beginning of the fiscal year all the land required for the construction of the two turning basins in the river had been secured except tracts Nos. 4, 6, and 15 and three short streets and an alley in the site for the South Branch Basin. These three tracts were paid

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for October 3, 1904, and the three streets and one alley were conveyed to the United States by ordinance of the city of Chicago November 28, 1904.

A contract was entered into February 23, 1905, with Chicago and Great Lakes Dredge and Dock Company, of Chicago, for dredging and building the docks necessary for the construction of the two turning basins, and work was begun March 9 on the North Branch Basin. At the close of the year all the old docks and 275,111 cubic yards of material had been removed from the site of this basin.

WORK BY SANITARY DISTRICT.

During the year reasonably rapid progress has been made by the Chicago sanitary district toward securing a channel of 26 feet mid-river depth and 200 feet width through the South Branch of the Chicago River for about 5 miles, from the mouth up to the drainage canal entrance, and in securing a clear navigable width of 140 feet through the draws of all bridges. It now looks as if this work might be entirely completed by 1907–1909.

During the year the wreck of the schooner *Stampede* was, at the expense of the United States, removed from the North Branch of the Chicago River by the Chicago and Great Lakes Dredge and Dock Company, at contract price of $985, and the wreck of the schooner *Winslow* was, at the expense of the city of Chicago, removed from the main river near Clark Street Bridge, where it had been aground for several years.

For detailed information, see report of Asst. Engineer G. A. M. Liljencrantz, attached.

It is proposed to apply the funds now available to the continuation of the construction of the two turning basins.

Money statement.

July 1, 1904, balance unexpended	$323,901.32
Received from sale of earth and old buildings	240.00
	324,141.32
June 30, 1905, amount expended during fiscal year, for works of improvement	162,473.45
July 1, 1905, balance unexpended	161,667.87
July 1, 1905 amount covered by uncompleted contracts	107,153.53

APPROPRIATIONS.

Act of June 3, 1896	$50,000.00
Sundry civil act, June 4, 1897	113,000.00
Sundry civil act, July 1, 1898	400,000.00
Sundry civil act, June 6, 1900	62,000.00
Act of June 13, 1902	306,457.00
Received from sale of earth and old buildings	1,721.12
Total	933,178.12
Expenditures to June 30, 1905 (exclusive of $25,000 allotted from appropriation for Chicago Harbor of August 18, 1894)	771,510.25
Balance unexpended July 1, 1905	161,667.87

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Abstract of contracts in force during fiscal year ending June 30, 1905.

Name of contractor.	Character of the work.	Price per unit.	Date of approval.	Date of beginning of work.	Date of expiration.
Chicago and Great Lakes Dredge and Dock Co., Chicago, Ill.	Dredging and construction of docks.	Dredging, 12¼ cents per cubic yard, measured in scows. Removing stone wall and substructure, $1,340. White-oak piles, each .. $12.25 Hardwood piles, each .. 6.00 Sheet piling, per linear foot ..... 13.50 Oak stringers, per M feet .. 45.00 White-oak timber, per M feet ..... 45.00 Pine timber, per M feet .. 40.00 Pine stringers, per M feet .. 37.50 Hemlock timber, per M feet ..... 35.00 Anchor rods, per pound .. .05 Screw bolts, per pound .. .05 Driftbolts, per pound..... .04 Spikes and nails ..... .08½	Mar. 1, 1905 (E.D. File No. 58436).	On or before Apr. 1, 1905.	On or before July 1, 1906.

REPORT OF MR. G. A. M. LILJENCRANTZ, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Chicago, Ill., July 6, 1905.

COLONEL: I have the honor to submit the following report on operations in Chicago River, Illinois, during the year ending June 30, 1905.

There was no contract in force at the beginning of the year for any work of improvement of this river.

WORK DONE DURING THE YEAR.

All the land required for the construction of the two turning basins in the river had been secured at the beginning of the year, except tracts Nos. 4, 6, and 15 for the South Branch Basin, which land belonged to the Chicago Terminal Transfer Railroad Company. The title to these three tracts having been approved by the Attorney-General, they were paid for on the 3d of October, 1904.

While thus all the tracts to be purchased had been secured at that time, there were three short streets and an alley in the site for the South Branch Basin to be secured to complete the possession by the United States of all the land required. These were conveyed to the Government by an ordinance passed by the Chicago city council on November 28, 1904.

The city of Chicago assessed taxes on a number of the tracts secured by the Government, and on the 9th of November, 1904, Col. O. H. Ernst, Corps of Engineers, U. S. Army, then in charge of this district, addressed a letter to the Department, giving a detail account of each and all of the cases subject to such taxation and requesting instructions as to what steps to take to protect the interests of the United States, but no reply to this letter has as yet been received.

On January 4, 1905, proposals for the construction of the two turning basins were advertised for and were opened on February 4 following. The Chicago and Great Lakes Dredge and Dock Company were the lowest bidders, at the following prices, to wit:

For dredging: 12¾ cents per cubic yard, measured in place.

For removal of the old lock wall in the South Basin: $1,340.

For sheet piling: $13.50 per linear foot (along dock).

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For white-oak piles, 45 feet long: $12.25 each.
Hardwood piles, 30 feet long: $6 each.
White-oak caps and fenders: $45 per thousand feet B. M.
Pine back logs: $40 per thousand feet B. M.
Oak stringers: $45 per thousand feet B. M.
Pine stringers: $37.50 per thousand feet B. M.
Anchor rods: 5 cents per pound.
Driftbolts: 4 cents per pound.
Screw bolts: 5 cents per pound.
Spikes: 3½ cents per pound.

All the prices for material furnished are for such materials "secured in the work."

A contract was entered into with the said firm on the 23d of February, 1905, and work under this contract was begun on the 9th of March following, consisting in the removal of the land and the old docks in the North Branch Basin, but no new docks have as yet been built.

At the close of the year all the old docks had been removed from the said basin and 63 per cent of the land, to wit: 275,111 cubic yards dredged and taken away.

WORK PROPOSED FOR THE YEAR ENDING JUNE 30, 1906.

It is proposed to continue and complete the work under the contract during the ensuing year.

* * * * * * *

At the beginning of operations under existing contract an old schooner, the *Stampede*, was found aground at the dock on the west side of the river within the territory secured for the turning basin. In this position it formed a serious obstruction to the progress of the work under the contract. The owner was notified, but after some futile attempts on his part to raise the wreck it was abandoned by him. A contract was then entered into with the Chicago and Great Lakes Dredge and Dock Company for the removal of the same at a cost of $985, and this was accomplished on the 28th of April, 1905.

Another old schooner, the *Winslow*, which has for several years been aground in the Main Branch east of the south abutment of Clark Street Bridge, was removed by the city of Chicago on June 26 last, but it sank again when nearing the Dearborn Street Bridge. It has since been blown up with dynamite, and the work of removing the débris is in progress.

Complaints from Chicago River navigation interests having been officially made to the effect that the Illinois Central Railroad Company's bridge at the mouth of the river formed an unreasonable obstruction to navigation, this bridge was, after a public hearing of all the parties interested, ordered by the Secretary of War on December 22, 1903, to be removed before April 15, 1904. This time limit was later—on March 12, 1904—extended to July 15, 1904. The bridge proper was so removed in June and the site deepened to the required 22 feet below city datum in July following of that year.

The construction of the following bridges was authorized by the Secretary of War during the year:

A bascule bridge at Twenty-second street, South Branch, July 14, 1904; a bascule bridge at Harrison street, same branch, September 13, 1904; a swing bridge at South Western avenue, West Fork, South Branch, March 31, 1905, and the following temporary bridges:

At Archer avenue, South Fork of South Branch, October 20, 1904; at Weed street, North Branch canal, December 7, 1904; at Twenty-second street, South Branch, May 22, 1905.

The following bridges were completed or removed: Completed—Bascule bridge at Deering street, in September, 1904; bascule bridge at North Western avenue, North Branch, December, 1904; bascule bridge at Eighteenth street, South Branch, in December, 1904. Removed—The temporary bridges at Harrison street, South Branch, in July, 1904, and North Western avenue, North Branch, in December, 1904.

I am, Colonel, very respectfully, your obedient servant,

G. A. M. LILJENCRANTZ,
Assistant Engineer.

Lieut. Col. W. H. BIXBY, *Corps of Engineers.*

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TUNNELS UNDER CHICAGO RIVER, ILLINOIS.

[Printed in War Department Document No. 227.]

LETTER OF THE CHIEF OF ENGINEERS.

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, June 6, 1904.

SIR: At the second session of the Fifty-eighth Congress an act was passed, entitled "An act declaring each of the tunnels under the Chicago River an obstruction to navigation, and for other purposes." (Public, No, 174.) This act was approved April 27, 1904, and it declares the tunnels under the Chicago River, in the State of Illinois, at La Salle street, Washington street, and near Van Buren street, in the city of Chicago, to be, as now constructed, unreasonable obstructions to the navigation of said Chicago River, and each of said tunnels is declared to be a public nuisance. The act imposes certain duties upon the Secretary of War, including the giving of notice to persons or corporations owning or controlling the tunnels, or any of them, to so alter the same as to render navigation over them free, easy, and unobstructed, and in giving such notice he is required to specify the changes recommended by the Chief of Engineers that are needed to be made in order that said tunnels, or any of them, shall not thereafter be an obstruction to navigation, and to prescribe in each case a reasonable time in which to make such changes; and the act further fixes a penalty for failure or refusal to make the changes specified in the notice of the Secretary of War under the provisions of said law.

Col. O. H. Ernst, Corps of Engineers, stationed at Chicago, was instructed by letter from this office, dated May 2, 1904, to cause a careful investigation and examination of these tunnels to be made and submit a full report as early as practicable, specifying the changes which, in his judgment, should be made in order to remove the obstructive character of the tunnels, and the time within which such changes should be completed, and he was authorized in this connection to hold a public hearing that the views of local and other interests might be fully presented.

I have just received Colonel Ernst's report, dated May 26, 1904, upon the subject of these tunnels, and as the work proposed involves a radical change in the condition of the Chicago River, requiring the expenditure of large sums of money, and is of vital interest to the people of Illinois, as well as to a vast number of citizens of other States, I have the honor to recommend, before further action in the matter is taken by the Department, that 100 copies of Colonel Ernst's report, together with report of proceedings at the public hearing held by him, be printed by the Public Printer upon the usual requisition for the use of this office.

Very respectfully,

A. MACKENZIE,
Brig. Gen., Chief of Engineers, U. S. Army.

Hon. WM. H. TAFT,
Secretary of War.

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[First indorsement.]

WAR DEPARTMENT,
June 6, 1904.

Approved as within recommended.
By order of the Secretary of War:

JOHN C. SCOFIELD,
Chief Clerk.

[PUBLIC—No. 174.]

AN ACT Declaring each of the tunnels under the Chicago River an obstruction to navigation, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the tunnels under the Chicago River in the State of Illinois at La Salle street, Washington street, and near Van Buren street, in the city of Chicago, in said State of Illinois, are, and each of them is hereby, declared to be, as now constructed, an unreasonable obstruction to the free navigation of said Chicago River, and each of said tunnels is hereby declared to be a public nuisance. And it shall be the duty of the Secretary of War to give notice to the persons or corporations owning or controlling said tunnels, or any of them, so to alter the same as to render navigation over said tunnels free, easy, and unobstructed, and in giving such notice he shall specify the changes recommended by the Chief of Engineers that are needed to be made in order that said tunnels, or any of them, shall not thereafter be an obstruction to navigation, and shall prescribe in each case a reasonable time in which to make said changes. If at the expiration of such time such changes have not been made, the Secretary of War shall forthwith notify the United States district attorney for the northern district of Illinois, in which said tunnels are situated, to the end that the criminal proceedings hereinafter prescribed may be taken. If the person or persons, corporation or corporations, owning or controlling any of the said tunnels shall, after receiving notice to that effect, as hereinbefore required, from the Secretary of War, and within the time prescribed by him, fail or refuse to remove the same or to make the changes specified in the notice of the Secretary of War, such person or persons, corporation or corporations, shall be deemed guilty of a misdemeanor, and on conviction thereof shall be punished by a fine not exceeding ten thousand dollars; and each and every month such person or persons, corporation or corporations, shall remain in default in respect to the removal or alteration of such tunnel shall be deemed a new offense and subject the person or persons, corporation or corporations, so offending to the penalty herein prescribed: *Provided*, That in any case arising under the provisions of this Act an appeal or writ of error may be taken from the district court or from the circuit court direct to the Supreme Court either by the United States or by the defendants.

Approved, April 27, 1904.

REPORT OF COL. O. H. ERNST, CORPS OF ENGINEERS.

CORPS OF ENGINEERS, UNITED STATES ARMY,
Chicago, Ill., May 26, 1904.

GENERAL: I have the honor to acknowledge the receipt of your letter of May 2, 1904, transmitting copies of the act of Congress approved April 27, 1904, which declares the three tunnels under the Chicago River, as now constructed, to be unreasonable obstructions to the free navigation of said river. I am required to make a full report concerning the tunnels, and to specify the changes which in my judgment should be made in order to remove their obstructive character and the time within which such changes should be completed.

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Authority was given also to hold a public hearing, if deemed by me desirable.

2. On the 4th of May I issued a call for a public hearing to be held at this office May 18, at which all parties in interest should have an opportunity to be heard. The parties in interest are (1) the city of Chicago, (2) the receivers of the Chicago Union Traction Company, (3) the trustees of the sanitary district, (4) the navigation interests, and (5) the owners of dock property on the river. Invitations to attend the hearing were sent to Hon. Carter H. Harrison, mayor of Chicago; Messrs. Fetzer, Sampsell, and Eckels, receivers of the Chicago Union Traction Company; Mr. Zina R. Carter, president of the sanitary district; Isham Randolph, esq., chief engineer, sanitary district; Capt. J. G. Keith, vessel owner and agent; Mr. L. O. Goddard, member Chicago River Improvement Association; Hon. James R. Mann, M. C.; and the general public were notified through the newspapers. A copy of my invitation to the mayor is hereto appended.[a] The letters to the others were identical, except in the last paragraph, where the verbal changes required to make them applicable were made.

3. The hearing was held at the time fixed, and a stenographic report of the proceedings was kept, of which a fair copy is hereto appended.

4. There is no controversy over the assertion that the tunnels as now constructed are obstructions to navigation and should be altered without unnecessary delay, but there are very serious legal and economic difficulties in the way, and it is therefore desirable that a statement should here be made of the gravity of the injury which they have inflicted and are daily inflicting upon the lake traffic of Chicago. The following table has been compiled from the records of this office, showing the number of tons of commodities received at and shipped from the Chicago River, and also the Calumet River—or South Chicago—for each calendar year from 1889 to 1902, inclusive. The Calumet River has been introduced to show whether or not there has been simply a shifting of lake traffic from one part of the city to another.

Year.	Chicago.	Calumet.	Total.	Year.	Chicago.	Calumet.	Total.
	Tons.	*Tons.*	*Tons.*		*Tons.*	*Tons.*	*Tons.*
1889	8,212,535	753,599	8,966,134	1896	6,347,168	2,973,724	9,320,887
1890	7,209,514	1,796,401	9,005,915	1897	7,149,759	3,493,218	10,642,977
1891	7,214,765	2,066,751	9,281,516	1898	7,391,454	4,117,526	11,508,980
1892	8,412,992	1,822,907	10,235,899	1899	6,189,365	3,229,874	9,419,239
1893	7,958,963	903,379	8,862,342	1900	5,873,070	3,783,674	9,656,744
1894	7,209,236	1,436,897	8,646,133	1901	6,184,242	3,995,277	10,179,519
1895	7,205,942	2,857,750	10,063,692	1902	5,184,792	4,454,428	9,639,220

5. An inspection of this table shows that while the gain in Calumet River has been very great, it has barely been sufficient to counterbalance the loss in Chicago River. The trade of the two combined was only a trifle more in 1902 than in 1889, and this in face of the fact that there was an enormous increase in the general trade of the Great Lakes during that period, and also in face of the fact that the growth of Chicago in population and wealth was very great. The trade of the Chicago River decreased over 3,000,000 tons, or more than one-third, between 1889 and 1902. The influences which cause a shifting

[a] Not printed.

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or growth of trade are numerous and complicated, and it is possible that there are influences at work here which do not now appear, but it seems to me evident that the trade of Chicago River was bound to decline when the stream ceased to have the capacity necessary to accommodate the large modern freight carriers. Obstructions in the river, such as encroaching docks, center-pier bridges, and tunnels, become more and more serious as the size of vessels increases. They have now reached the stage where the largest and most economical freight carriers can not use the Chicago River at all except near its mouth. Such vessels draw about 20 feet. The depth of water over the tunnels is about 17 feet in two cases and about 18 feet in the third, which limits safe navigation to a draft of about 16 feet. Large vessels may, with difficulty, get by the other obstructions just mentioned, but they can not get over the tunnels. The tunnels are the most serious obstructions in the river, and must, I think, be charged with the greater part of the loss of trade. It is certainly useless to hope for its restoration before they are altered. It is more probable that the decay of the river's traffic will continue until that is done, notwithstanding that the other obstructions—center-pier bridges and encroaching docks—are being systematically removed by the trustees of the sanitary district. If the extent of the injury could be measured in money, its amount would undoubtedly be stated in millions.

6. The Chicago River, in addition to its duty as a navigable stream, has to perform the functions of a discharging channel to carry the large volume of water required to dilute the sewage now being discharged into the Des Plaines and Illinois rivers through the new drainage canal. Its area of cross section must be made large enough to accommodate the required volume without creating velocities which will be detrimental to navigation. The plans upon which the trustees of the sanitary district are working contemplate the ultimate discharge through the drainage canal of 10,000 cubic feet per second, of which 8,000 cubic feet are to pass through the part of the river where these tunnels are located. The trustees are now at work enlarging the river to fit it for this new duty. They have replaced many of the center-pier bridges with bascule bridges, and expect to replace all. They have widened and deepened the river in many places, but they have no present intention of attacking the tunnels. The depth which they have adopted is 26 feet for a width of 100 feet in the middle of the stream, decreasing to a depth of 16 feet at the dock line. This gives an area of cross section of about 4,700 square feet. At the bridges, however, it is reduced to about 4,000 square feet. As vessels will not be moored at the bridges, the whole of this cross section is available for flow and should be able to discharge 8,000 cubic feet per second at a low velocity. In reconstructing the tunnels, there must be provided an equal area of cross section over them—that is, 4,700 square feet where there is no bridge and 4,000 square feet where, as at Washington street, there is a bridge.

7. At present the amount of water which the trustees are allowed to pass through the river is limited by the Secretary of War to about 4,100 cubic feet per second, so that for the present a less area is permissible.

8. Cross sections of the river at the sites of the three tunnels, showing the roofs of the tunnels as they intersect the bed and affect naviga-

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tion, are shown on the inclosed drawing.[a] At La Salle street the river is 278 feet wide, and there is a channel 17 feet deep for a width of 62 feet over the tunnel near the middle of the river. The area of cross section available for flow is 4,193 square feet. A depth of 22 feet will accommodate the deepest-draft vessels now navigating the lake, and at this place it will furnish the area of cross section required to discharge 8,000 cubic feet per second at a low velocity. There can be no certainty, however, that the draft of vessels navigating the Lakes will not be increased in the future. The rock bottom in St. Marys and Detroit rivers is a serious obstacle to deeper channels, but it is not insuperable, and it would not be prudent to say that they will never be made. It is my opinion that the La Salle street tunnel should be altered so that there shall be a depth of water over it of at least 26 feet for a length of 160 feet near the middle of the river.

9. At Washington street the river is only 150 feet wide, and of this width 35 feet at the middle of the river is occupied by the pier of a drawbridge, leaving two passageways, one 58 and the other 57 feet wide. In each of these there is a depth of 17 feet, but the width for that depth is not great enough for a vessel to pass, and practically the depth is not more than 16 to 16½ feet. The lumps shown in the profile of the tunnel are said to be due to the deposit of cement in sacks to stop leaks. The area of cross section available for flow is 1,911 square feet, which is barely sufficient to pass the 4,100 cubic feet per second now authorized by the Secretary of War. The work of enlargement by the trustees of the sanitary district just above the tunnel is completed and just below it is well advanced. The sudden change from a cross section of 4,700 square feet to one of 1,911 square feet causes a change of velocity which adds to the difficulty of steering, a difficulty which is increased by the break in the shore line. This tunnel is the most serious obstruction in the Chicago River. It limits not only the draft of vessels, but also the amount of water which can be allowed to flow through the drainage canal. The center-pier bridge is to be replaced by a bascule bridge. The tunnel should be altered so that no portion of it between the abutments of the proposed new bridge shall come within 26 feet of the water surface.

10. At the Van Buren street tunnel the river is 184 feet wide, and there is a channel 17 feet deep for a width of 92 feet near the middle of the river, with a maximum depth of 18 feet at the center. A vessel drawing 17½ feet can, with care and good luck, be passed over this tunnel when the level of Lake Michigan is not unusually low. The area of cross section available for flow is 3,128 square feet. Under the plans of the trustees of the sanitary district the width of the river here is to be made 200 feet. This tunnel should be altered so that there shall be a depth of water over it of at least 26 feet for a length of 160 feet near the middle of the river.

11. The Washington street tunnel was the first one constructed, and was completed in 1869. It was built by the city of Chicago, at a cost of about $517,000, including discount on bonds and damages, or about $450,000 for actual construction and superintendence. The depth of water over it was about 14 feet, which was deemed sufficient to accommodate the vessels then in use. It was used as a public highway

[a] Not printed.

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exclusively until 1886, and is still owned by the city. By city ordinance dated February 1, 1886, amended February 8, 1886, and again amended March 30, 1888 (copies hereto appended, pp. 22 to 26, Proceedings at public hearing), the Chicago Passenger Railway Company was authorized to lay tracks and operate a cable street railroad through the tunnel for a period of twenty years, one of the conditions being that the company should keep the tunnel in repair. The city retained the right for the public to use the tunnel with teams or by foot passengers—a right now rarely, if ever, used. The privilege was accepted by the company March 8, 1886, and expires twenty years from that date, or March 8, 1906. It still has about two years to run. During the year 1889 the company made extensive alterations and repairs in the tunnel, among other things lowering the roof so as to provide about 3 feet additional depth, at a total cost stated to be $90,000. Before this work was completed, but after the contract for it was made, the Chicago Passenger Company leased its lines of railway, including its rights in the tunnel, to the West Chicago Street Railroad Company. Afterwards, on June 1, 1899, the latter company leased all its railway property to the Chicago Union Traction Company. This company is now in the hands of receivers. It claims through the receivers a right to the free and undisturbed use of the tunnel until March 8, 1906.

12. The La Salle street tunnel was built in 1870–71 by the city of Chicago, at a cost of about $566,000. It was used exclusively as a public highway for teams and foot passengers until 1886, and is still owned by the city. By city ordinance dated July 19, 1886 (copy hereto appended, pp. 26 to 29, Proceedings at public hearing), the North Chicago Street Railroad Company was authorized to lay tracks and operate a cable railroad through the tunnel for a period of twenty years, the city retaining the right for the public to use the tunnel with teams or as foot passengers, as in the other case—a right now rarely, if ever, used. The privilege will expire on July 19, 1906. The company was to pay an annual rental, or in lieu thereof to build bridges at Clark street and at Wells street. It built the bridges, at a cost stated to be over $500,000. On the 1st of June, 1899, the North Chicago Street Railroad Company leased all of its railroad properties, including the right to use the tunnel, to the Chicago Union Traction Company, which company, as already stated, is now in the hands of receivers.

It claims a right to the free and undisturbed use of the tunnel until July 19, 1906.

13. The tunnel near Van Buren street was built by the West Chicago Street Railroad Company, 1890–1894, under the authority of a city ordinance dated April 2, 1888 (copy hereto appended, pp. 29 and 30, Proceedings at public hearing), at a cost of about $800,000 for construction. On the 1st of June, 1899, the West Chicago Street Railroad Company leased all of its railroad property, including this tunnel, to the Chicago Union Traction Company, which company, through its receivers, is now the "corporation owning or controlling said tunnel."

14. On the 12th of July, 1900, the city of Chicago filed three petitions for mandamus in the circuit court of Cook County against the Chicago Union Traction Company and its underlying companies to

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compel the lowering of the three tunnels at the expense of the companies. So far as the cases have progressed, the advantage does not appear to be in favor of the city, but they are still in court. The city corporation counsel hopes for a decision by the end of the present year. The city is also engaged in litigation with the Chicago Union Traction Company over the question when their rights of occupancy of the streets expire and other questions of such importance and difficulty that they will almost certainly be carried to the United States Supreme Court after their decision in the present court. The corporation counsel hopes that a final decision may be reached during the winter of 1904–5.

15. The number of passengers carried during the year ending April 30, 1904, by the cable lines using the La Salle street tunnel was 37,409,702; by those using the Washington street tunnel it was 37,594,828; by those using the Van Buren street tunnel it was 13,646,546—an average of about 100,000 daily for the first two and 37,000 daily for the last. A majority of these people passed through the tunnels, the exact percentage not being of record. The average number of cars passing through the tunnels daily is now about 2,007 at La Salle street, 2,000 at Washington street, and 540 at Van Buren street. The cars are usually run in trains of one grip car and two trailers each. Between 7 and 9 in the morning and between 5 and 7 in the evening the interval between trains in each direction is for La Salle street, fifty-two seconds; for Washington street, forty-five seconds, and for Van Buren street, two minutes. At other hours during the day it is one minute for La Salle street, fifty-five seconds for Washington street, and two and one-half minutes for Van Buren street. In one direction or the other trains are passing through the tunnels at one-half these intervals. If separate electric cars were used instead of the trains, there would be a car passing every thirteen seconds for La Salle street, every eleven seconds for Washington street, and every thirty seconds for Van Buren street during the crowded hours, and at rather greater intervals at other hours. To turn these cars over the bridges will of course make trouble.

16. In addition to this traffic, the La Salle street tunnel carries a 36-inch water pipe, constituting an important link in the city water supply; and both the La Salle street and Washington street tunnels carry a large number of wires for electric lighting, telephone, and telegraph services. There are probably a hundred or more cables in each of these tunnels.

17. The tunnels differ from each other in construction and admit of different treatment in the methods of alteration. Cross sections of the river portion of each tunnel are shown on the inclosed drawing. At Van Buren street the greater part of the work can be done without suspending the cable-car traffic, but that will involve retaining the present roof until the end of the work. With that method no immediate relief to navigation would be given. At La Salle and Washington streets the river section must be removed and reconstructed almost entirely, and the tunnels would be disabled at the start. In those cases there is no good reason why the first work should not be directed so as to relieve navigation soon after it is begun.

18. The city expresses a desire to have the obstructions to navigation removed, but it objects to the immediate removal of the present

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tunnels (see statement of corporation counsel, p. 18 et seq., Proceedings at public hearing) in the first place because they are needed by the public. It is true that to alter or remove the present tunnels will cause great inconvenience to a large number of people, but that will always be the case. The inconvenience must be faced and endured. It will not be diminished by delay, but will rather be increased as the population of the city grows and the traffic through the tunnels increases.

19. The city objects to action at this time also because its standing in the litigation mentioned in paragraph 14 (p. 9) may be prejudiced thereby. It prefers that action be deferred until its rights in respect to the controverted questions be determined by the courts. How far an act compelled by the superior power of the Federal Government can affect the preexisting rights of the city with reference to third parties is a legal question upon which I express no opinion. Admitting for the moment that it will have a prejudical effect, it seems to me that any injury which the city can possibly suffer therefrom is small compared with the injury which it is suffering from the tunnels. That is only a contingent injury of uncertain but moderate proportions, while this is a positive, ever-present injury of vast magnitude. The uncertainties of the law are proverbial. To await the final result of these trials is to delay for a length of time which is quite uncertain, with the hope of obtaining advantages the extent of which is questionable.

20. The city objects to immediate action also because the funds required to do the work are not now available and will not be until an appropriation can be made by the city council, which, under the laws of Illinois, can not be done before January next. This objection is conclusive for the period which it covers—that is, the remainder of the current year.

21. The receivers of the Chicago Union Traction Company object to present action—(see p. 12 et seq., Proceedings at public hearing)—because their right to use the La Salle and Washington street tunnels, for which they have given a valuable consideration, still has two years to run, and their ownership of the Van Buren street tunnel will be worthless to them if they are deprived of the use of the streets, which latter question is now in litigation. These are questions of the amount of damages which the traction company may obtain from the city, to be determined in the courts, and can not be affected in any important degree by delay.

22. The receivers claim that the Government of the United States under the act of Congress relating to these tunnels, has no authority to compel the lowering of the Van Buren street tunnel, and no power to remove it without making full compensation. Their ground for this claim is given in full in their statement (pp. 16 and 17, Proceedings at public hearing). That, of course, is a question of law upon which I have no opinion to express.

23. A reasonable time to allow for reconstructing the tunnels at a lower level will be from eighteen months to two years after the work is begun. It should cover two winter seasons, when navigation is suspended. In the meantime relief to navigation and increased discharging capacity can be furnished within two months after the work is begun in the case of two of the tunnels—the two worst.

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24. My opinion is that the city of Chicago should be required to alter the La Salle street tunnel so that there shall be a depth of water over it of at least 26 feet for a length of 160 feet near the middle of the river, the work to be completed on or before March 15, 1907, and to be so begun and conducted that on and after April 1, 1905, there shall be a navigable channel over the tunnel not less than 22 feet deep.

25. Furthermore, the city of Chicago should be required to alter the Washington street tunnel so that no portion of it between the abutments of the proposed new bridge shall come within 26 feet of the water surface, the work to be completed on or before March 15, 1907, and to be so begun and conducted that on and after April 1, 1905, there shall be a navigable channel over the tunnel at least 22 feet deep.

26. The receivers of the Chicago Union Traction Company should be required to alter the tunnel near Van Buren street so that there shall be a depth of water over it of at least 26 feet for a length of 160 feet near the middle of the river, the work to be completed on or before April 15, 1906.

Very respectfully, your obedient servant,

O. H. ERNST,
Colonel, Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

REPORT OF PROCEEDINGS HAD AT A MEETING BEFORE COL. O. H. ERNST, CORPS OF ENGINEERS, U. S. ARMY, AT CHICAGO, ILL., ON MAY 18, 1904, UPON THE SUBJECT OF THE TUNNELS UNDER THE CHICAGO RIVER, IN THE CITY OF CHICAGO, BEING UNREASONABLE OBSTRUCTIONS TO NAVIGATION.

The meeting was called to order by Col. O. H. Ernst, Corps of Engineers, at 10 o'clock a. m.

The following gentlemen were present when the meeting was called to order: Hon. James R. Mann, M. C.; Mr. S. G. Artingstall, representing the Chicago Union Traction Company; Mr. Milton J. Foreman, representing the city of Chicago; Capt. D. Sullivan, president of the Chicago River Improvement Association; Mr. R. J. Dunham, secretary of the Chicago River Improvement Association; Mr. H. D. Ford, chairman of the transportation committee.

Between 10 o'clock and 10.30 the following gentlemen arrived in the meeting room:

Mr. Edgar B. Tolman, representing the city of Chicago; Mr. Isham Randolph, chief engineer of the sanitary district of Chicago; Capt. J. G. Keith, vessel owner and agent; Mr. Louis A. Seeberger, Mr. Henry H. Walker, Mr. Robert E. Ismond, members of Chicago Real Estate Board; Mr. W. J. Conley, corporation counsel, city of Chicago; Mr. Francis Beidler, Mr. Arthur C. Helm, Mr. E. Lee Heidenreich.

In addition to the above-mentioned gentlemen, there were also present several reporters representing various newspapers in the city of Chicago.

Colonel ERNST. Gentlemen, the hour fixed for the hearing has arrived; the meeting will please come to order.

At the last session Congress passed this law, which was approved by the President on the 27th of April, 1904.

Colonel Ernst then read the law (Public—No. 174), being "An act declaring each of the tunnels under the Chicago River an obstruction to navigation, and for other purposes." (Copy herewith.)

Colonel ERNST (continuing). This printed copy of this law was sent to me with a letter of instructions from the Chief of Engineers, directing me to make a report, giving my opinion and specifying the changes which should be made in order to remove the obstructive character of the tunnels and the time within which such change should be completed. I have asked all parties in interest to

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be present at this meeting. I have asked the city authorities, the receivers of the traction company, the navigation interests, and the members of the drainage board to come here to-day and let me hear what they have to say. I wish to hear all sides of this question.

It is perfectly evident that these tunnels are a nuisance; the law says so, and it is evident to everybody. The question to be decided is, How much must they go down—how much must they be lowered, and when?

The city is represented by Mr. Foreman and Mr. Tolman. We will hear from them.

Mr. TOLMAN (representing the city of Chicago). In accordance with the instructions of Colonel Ernst's letter, the city put in writing what it had to say, and it happens that the transmission of that document is delayed. If you will hear from others while it is coming, I will be very glad to present it as soon as it arrives.

Accordingly Colonel Ernst read a letter from the Chicago Union Traction Company receivers, dated May 17, 1904, and signed by Messrs. James H. Eckels, Marshall E. Sampsell, and John C. Fetzer, receivers. The letter is as follows:

CHICAGO UNION TRACTION COMPANY, LAW DEPARTMENT,
Chicago, May 17, 1904.

Col. O. H. ERNST,
Corps of Engineers, U. S. A.

SIR: Replying to your official communication of the 4th instant to the undersigned, as receivers of the Chicago Union Traction Company, in reference to the tunnels under the Chicago River at La Salle street, at Washington street, and near Van Buren street, we desire to state:

First. As to what changes should be made in order to remove the obstructive character of the tunnels and as to the time within which such changes should be completed we have consulted Mr. Samuel G. Artingstall, civil engineer, of this city, upon whose judgment we greatly rely because of his peculiar qualifications in the premises. He not only constructed for the West Chicago Street Railroad Company the tunnel near Van Buren street, but had charge, for the city of Chicago and the Chicago Passenger Railway Company, of the reconstruction and lowering of the tunnel at Washington street.

Mr. Artingstall was also connected with the engineering department of the city of Chicago from 1869 to 1888, and during the last five years of that period was engineer in chief of the city of Chicago and the officer of the city particularly in charge of the Chicago River and its branches.

He was again chief engineer for the city of Chicago during the years 1893, 1894, and 1895.

Early in February of the present year Mr. Artingstall was retained by the undersigned as special engineer for the purpose of determining and reporting to the undersigned the most feasible and expeditious manner of lowering the tunnels near Van Buren street, at Washington street, and at La Salle street, and particularly to determine and report to the undersigned in what manner the work could be done so as to interfere as little as possible on the one hand with the navigation in the river and on the other hand with the use of the tunnels for street railway and public purposes.

Mr. Artingstall has prepared plans and estimates and formulated methods for doing the work in the most expeditious manner possible, and has submitted them to the undersigned.

Second. Mr. Artingstall informs us that owing to the changed conditions in the river, arising from the opening of the drainage canal, and arising also from the construction of the bridge of the Metropolitan West Side Elevated Railway Company between Jackson and Van Buren streets, and the city bridge at Van Buren street, and the consequent narrowing of the channel of the river at those points it would seriously interrupt navigation to attempt the river work of reconstructing the Washington street and Van Buren street tunnels during the season of navigation. The erection of cofferdams and the placing in the river of the crafts necessary to prosecute the work where the stream is as narrow as it is at Van Buren and Washington streets would cause such a rapid current that the navigation of the river would be very seriously interrupted.

The situation at Washington street is further complicated by the fact that the sanitary district and the city of Chicago propose to erect a new bridge at that point, the foundations of which would necessarily rest upon the tunnel. The sanitary district and the city have not yet settled on a plan for the bridge, and until that is done it would be impossible to determine when the work could be

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commenced on the tunnel at Washington street. In view of the foregoing facts, Mr. Artingstall is of the opinion that the work upon the tunnels at La Salle street, Washington street, and near Van Buren street, using the utmost expedition, could not be completed within two years after the commencement of the work.

In the case of the tunnels at Washington street and near Van Buren street the time as to work in the river bed would have to include two full winters.

The situation at La Salle street has a peculiar complication in that the main water pipe, supplying the central district of Chicago, has been placed under the footway of that tunnel, and provision would have to be made to keep up the supply of water before the pipe could be removed. In Mr. Artingstall's opinion, the work on the water pipe would require at least six months' time before the work of lowering said tunnel could be commenced.

The river at La Salle street is wide enough to permit of the work being carried on in the summer time without serious impairment of or interruption to navigation.

Third. As to what changes should be made in order to remove the obstructive character of the tunnels, Mr. Artingstall has given this subject very careful examination and study, and has interviewed upon the subject the more prominent vessel men of Chicago, and the officials of the sanitary district and civil engineers acquainted with the Chicago River, and with the navigation upon the same, and reports to the undersigned that the consensus of opinion, outside of the sanitary district, is that if the crowns of the tunnels were placed 22 to 23 feet below city datum all practical purposes would be subserved.

The engineers of the sanitary district are inclined to think, according to Mr. Artingstall's report, that in order to meet all emergencies 26 feet in the channel below city datum should be the depth of the river.

The depth to which the tunnels should be lowered having been determined, it only remains to adopt the best, most expeditious, and economical methods of removing the tops or crowns of the tunnels, so that no part of the same should be above the determined depth of the channel.

At the request of the undersigned, Mr. Artingstall will appear at the meeting referred to in your communication, prepared to answer any questions according to the best of his ability or to give any information possessed by him upon this subject which may be desired.

Fourth. Inasmuch as you stated in your said communication that all papers will be laid before the Secretary of War for his decision, we wish to take this opportunity to place ourselves upon record as to our position respecting the tunnels in question.

As to the tunnels at La Salle street and Washington street, it is perhaps not necessary to say anything further here than that these tunnels, respectively, were constructed by the city of Chicago and remained in its sole and exclusive possession as public highways until February 1, 1886, as to the Washington street tunnel, and until July 19, 1886, as to the La Salle street tunnel.

By ordinance of the city council of the city of Chicago, adopted February 1, 1886, and accepted by the Chicago Passenger Railway Company March 8, 1886 (see Vol. II, City Ordinances, pp. 1290–1292), permission and authority were granted to said company, its successors and assigns, to lay down, construct, maintain, and operate for a period of twenty years from the passage of said ordinance a double or single track cable railway in, upon, over, and along certain streets, specifically described in said ordinance, in the city of Chicago, and among other things, on Washington street from Des Plaines street to Michigan avenue, including the tunnel at Washington street under the Chicago River. It is provided in the ordinance that the tracks in the tunnel should be so laid that cars in passing through the tunnel should be operated so as not to delay unnecessarily public travel.

Pursuant to said ordinance, the Chicago Passenger Railway Company laid through and in said tunnel a double track cable street railway, and since said time, by itself and its lessees, has continuously operated a street cable railway through said tunnel. This right of user for street railroad purposes was not and has not been exclusive and applied in no manner to the foot passageway on the south side of said channel.

Fifth. At the time of the passage of the aforesaid ordinance, and for a long time theretofore, said tunnel was in a very bad state of repair, so that the water of the river was constantly leaking into the said tunnel, and the same was practically abandoned by the public as a highway, and was not used on account of

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its leaky condition and bad repair. In order to render said tunnel safe and convenient for travel, both by street cars and other vehicles, and in reliance on the right to use said tunnel for the full term of twenty years, the said Chicago Passenger Railway Company, during the year 1889, at the request and with the consent and approval of the said city of Chicago, rebuilt the river section of said tunnel and repaired the remainder of said tunnel at a large expense, to wit, the sum of $90,000, the result of such repairing and reconstruction being that said tunnel was rendered water-tight and fit for use, and has ever since so remained, and the top of said tunnel, in the center of the channel, was thereby lowered 3 feet below its former height, to wit, from 14 feet below city datum to 17 feet below city datum, and at the dock lines the top of said tunnel was thereby lowered 4 feet below its former height, to wit, from 12 feet below city datum to 16 feet below city datum.

This work, as before stated, was done under the supervision of Mr. Samuel G. Artingstall, civil engineer.

Sixth. The contract for the reconstruction of said Washington street tunnel was made by the Chicago Passenger Railway Company, but before the work was completed the Chicago Passenger Railway Company, on November 16, 1888, leased its lines of railway, including its rights in the aforesaid tunnel, to the West Chicago Street Railroad Company, and the reconstruction of said tunnel was finished during the year 1889.

Afterwards, on June 1, 1899, the West Chicago Street Railroad Company leased all its railway property, including the transfer of its rights as lessee in the property of the Chicago Passenger Railway Company, to the Chicago Union Traction Company, and the Chicago Union Traction Company and its receivers have been operating said property and using said tunnel continuously since July 1, 1899.

Seventh. By ordinance adopted July 19, 1886 (see Vol. II, City Ordinances (1897), pp. 1474–1479), the city council of the city of Chicago granted to the North Chicago Street Railroad Company the right to construct, maintain, and operate a double-track cable street railroad upon certain streets in said ordinance particularly named and described, and, among others, on La Salle avenue and La Salle street, through the La Salle street tunnel, from Illinois to Jackson street, for a period of twenty years from the date of the passage of said ordinance, in consideration that the North Chicago Street Railroad Company should pay to the city of Chicago, as a fee for the license or permission to lay its cables and tracks and run its cars through said La Salle street tunnel, the sum of $25,000 per annum, payable semiannually on the 1st days of January and July of each year during the time said tunnel was used by said company, the time to commence when said company should begin to dig its trenches or lay its tracks through said tunnel; provided, however, that if the company should erect a certain four-track iron bridge, particularly described in said ordinance, at Clark street in lieu of the then bridge at that point such license fee was to be reduced to the sum of $10,000 per annum; and provided further, that if the North Chicago Street Railroad Company should also in a similar manner erect a four-track iron bridge, particularly described in said ordinance, over the river at Wells street and Fifth avenue in lieu of the then bridge at that point said license fee should cease to be paid.

This ordinance was accepted by the North Chicago Street Railroad Company October 11, 1886, and the construction of the double cable tracks of the company was commenced and prosecuted to a speedy conclusion, and the cost to said company of laying its cables and tracks through said tunnel was the sum of $1,800,000, all of which was done by the North Chicago Street Railroad Company, relying upon its right to use said tunnel for the full term of twenty years.

Afterwards the North Chicago Street Railroad Company erected, in the manner provided in said ordinance, both the bridge at Clark street and the bridge at Wells street and Fifth avenue in lieu of paying, as provided in said ordinance, the sum of $25,000 as annual rental for the license or permission to lay cables and tracks and run its cars through said La Salle street tunnel.

The cost to the company of the construction of each of said bridges was in excess of the sum of $250,000.

The use of said tunnel for railway tracks as above specified was not exclusive in said North Chicago Street Railroad Company and did not in any manner apply to the foot passage on the east side of said tunnel.

The North Chicago Street Railroad Company, by lease dated June 1, 1899, leased all its railroad properties, including the rights granted to it as to said La Salle street tunnel under the aforesaid ordinance, to the Chicago Union

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Traction Company, and that company and its receivers have continuously operated said railroad properties and used said tunnel as aforesaid from July 1, 1899, to the present time.

Eighth. It will be noted that the aforesaid ordinances provide the right of user of both the Washington street and La Salle street tunnels will terminate in about two years—the Washington street tunnel on February 1, 1906, and the La Salle street tunnel on July 19, 1906.

It will be further noted, from what has been stated, that the right of user of the Chicago Union Traction Company, as the lessee of the North Chicago Street Railroad Company, and as the lessee, by assignment, of the Chicago Passenger Railway Company, is limited to placing and maintaining tracks and cables in the floors of said tunnels and keeping said tunnels in repair, and that such user is not exclusive of the rights of the public to use said tunnels as public highways and does not apply at all to the foot passages adjacent to and forming a part of said tunnels.

The ownership of said tunnels, subject only to the right of user aforesaid by the Chicago Union Traction Company, or its receivers, of said tunnels for the purposes aforesaid, is in the city of Chicago, and it is respectfully submitted that upon the city of Chicago falls the burden of providing for the lowering of said tunnels, if it shall be determined, under the act of Congress mentioned in your communication, that the said tunnels can be required to be removed or lowered.

It is only fair to state in this connection that the undersigned are merely the officers of the United States circuit court for the northern district of Illinois, and will be governed as to their action in the premises by the orders and directions of that court, and that it remains for said court to determine as to the official action of the undersigned in the premises, and the undersigned do not wish this communication to be construed as an admission by them either of the validity of the act of Congress in question or as to the right of the Government of the United States to require the removal or lowering of said tunnels or any of them.

Ninth. As to the tunnel near Van Buren street, the situation is entirely different from that of either the Washington street or the La Salle street tunnel. The construction of the tunnel near Van Buren street was authorized by a resolution concerning an agreement for a tunnel under the river between the West Chicago Street Railroad Company and the city of Chicago, adopted April 2, 1888 (see Vol. II, City Ordinances (1897), p. 1593), whereby the West Chicago Street Railroad Company agreed, at its own expense, to construct a tunnel under the Chicago River and acquire the necessary right of way therefor, the route to be selected by said company at some point between Madison and Twelfth streets, with the east terminus at Fifth avenue or west thereof and the western terminus at Halsted street or east thereof; provided that the company should have the right from the city to construct said tunnel under any intervening street or streets and said river within said limits, said tunnel to be used by the company for street-railway tracks and to be commenced within three years and to be completed within four years from the time of the adoption of the ordinance authorizing the same; and whereby the said agreement of the West Chicago Street Railroad Company was accepted by and on behalf of the city of Chicago, and authority was thereby granted to said company to make the improvements above mentioned.

Relying upon the said ordinance, the West Chicago Street Railroad Company caused to be purchased land at a cost of over $1,000,000, and built a tunnel as authorized by said ordinance, at an additional cost of $800,000, under the South Branch of the Chicago River at a short distance north of the north line of Van Buren street, the center of said tunnel being 125 feet north of the north line of said Van Buren street.

The bed of the stream at the time of the commencement of construction of said tunnel was at the center of the channel less than 16 feet below city datum, and at the dock lines from 6 feet at the west dock line to about 12 feet at the east dock line. The crown of the tunnel when completed was 18 feet below city datum under the channel of the river and at the dock lines 16 feet below city datum. The tunnel was constructed wholly in the land of the West Chicago Street Railroad Company, and at no point reached within 2 feet of the bottom of the river.

Said tunnel was erected in the manner specified by the commissioner of public works, and has been in constant use, with the full knowledge of the city of Chicago and the United States Government, from the time of its completion to the present time.

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As before stated, the West Chicago Street Railroad Company on June 1, 1899, leased all of its railroad property, including the tunnel in question, to the Chicago Union Traction Company, and that company and its receivers have been in continuous use of said tunnel from July 1, 1899, to the present time.

Tenth. At the outset the undersigned desire to state that they are advised by counsel that the Government of the United States under the act of Congress in question has no authority to compel the lowering of said tunnel, and no power to remove it without making full compensation to the owners of and parties interested in the said tunnel; and the undersigned believe that a short statement of the reasons advanced by counsel for their advice in the premises is appropriate, in view of the statement that this communication shall be placed before the Secretary of War for his decision.

1. The tunnel was built by the West Chicago Street Railroad Company wholly below the natural bed of the river, in land of which it was the owner, and was built in pursuance of a right guaranteed to the owners of such lands under the bed of navigable rivers in Illinois by repeated decisions of the courts of Illinois and of the Supreme Court of the United States. The West Chicago Street Railroad Company owned the property on both sides of the river at the points at which said tunnel was constructed, and hence was the owner of all of the ground under the natural bed of the river.

The English or common-law rule defining what streams are navigable in law is the law in Illinois.

By the common law the ebb and flow of the tide is the test of navigability. Where the tide makes itself felt the bed of the stream belongs to the sovereign. The bed of nontidal streams which are not deemed navigable belongs to the riparian owner. (Middleton *v.* Pritchard, 3 Scam., 510; Canal Trustees *v.* Haven, 6 Gil., 548; Canal Trustees *v.* Haven, 11 Ill., 554; Ensminger *v.* People, 47 Ill., 384; City of Chicago *v.* Laflin, 49 Ill., 172; City of Chicago *v.* McGinn, 51 Ill., 266; Braxon *v.* Bressler, 64 Ill., 488; Railroad Co. *v.* Stein, 75 Ill., 41; Houch *v.* Yates, 82 Ill., 179; Cobb *v.* La Vall, 89 Ill., 331; Washington Ice Co. *v.* Shortall, 101 Ill., 46; Village of Brooklyn *v.* Smith, 104 Ill., 429; Piper *v.* Connelly, 108 Ill., 646; McCartney *v.* C. and E. I. R. R. Co., 112 Ill., 611; Butternutt *v.* St. Louis B. Co., 123 Ill., 335; Fuller *v.* Shedd, 161 Ill., 462; Trustees of Commons *v.* McClure, 167 Ill., 23; Ballance *v.* City of Peoria, 180 Ill., 29; Bell Fontaine Imp. Co. *v.* Needringhaus, 181 Ill., 426.)

This doctrine has been so long adhered to that it has become a rule of property. (Braxon *v.* Bressler, supra; Ballance *v.* City of Peoria, supra.)

The Supreme Court of the United States has repeatedly held that grants of public lands bounded on streams, made without reservation or restriction (as is the case here), are to be construed, as to their effect, according to the law of the State in which the land lies. (Hardin *v.* Jordan, 140 U. S., 371–520; Grand Rapids and Ind. R. R. Co. *v.* Butler, 159 U. S., 87–92; St. Anthony Falls Water Power Co. *v.* St. Paul Commissioners, 168 U. S., 349; St. Louis *v.* Rutz, 138 U. S., 226–242; Shively *v.* Bowby, 152 U. S., 1.)

In Hardin *v.* Jordan and G. R. and I. R. R. Co. *v.* Butler, supra, the decision of the supreme court of Illinois in Middleton *v.* Pritchard (3 Scam., 510–520, supra) was quoted with approval.

The title, therefore, to the land in which the tunnel was constructed being in the railroad company, the tunnel could never become a public nuisance, as the supreme court of Illinois decided in the case of McCartney *v.* C. and E. I. R. R. Co. (112 Ill., 611, supra). On page 636, the supreme court, after citing cases holding the title of the railroad company extended to the center of the Chicago River, said:

"There is, then, no question of purpresture. There is no intrusion upon the property of the State and no public nuisance resulting from an invasion of the property rights of the people."

This language was used with reference to a bridge, which the attorney-general charged to be an obstruction to navigation.

2. The tunnel in question was constructed pursuant to a resolution and agreement between the city council of the city of Chicago and the West Chicago Street Railroad Company. At the time the said ordinance was passed and the agreement made, under the law of Illinois, the city of Chicago had full jurisdiction over the Chicago River, and could have closed the river had it seen fit to do so. (Starr & Curtis, Rev. Stats. Ill., chap. 24, par. 63, sec. 28–30; Escanaba *v.* Chicago, 107 Ill., 678; Transportation Co. *v.* Chicago, 99 U. S., 635; Gilman *v.* Philadelphia, 3 Wall., 713; Wilson *v.* Blackbird Creek Marsh Co., 2 Peters, 345;

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Cardwell *v.* Bridge Co., 113 U. S., 205; Prosser *v.* No. Pac. Ry. Co., 152 U. S., 64; Corrigan Trans. Co. *v.* Sanitary District, 125 Fed., 611.)

3. The tunnel structure, therefore, having been at its inception a lawful structure, lying wholly in and upon the property of the West Chicago Street Railroad Company, the crown thereof being more than two feet below the then bed of the stream, could not become a nuisance or unlawful by any subsequent change in the river, either from natural causes or from any improvements thereof which thereafter might be deemed desirable. (Yates *v.* Milwaukee, 10 Wall., 497; Laughlin *v.* City of Chicago, 49 Ill., 172; Williams *v.* Wilcox, 8 Adolph & L., 314; Ewing *v.* Colquohoun (H. of L.), 2 App., 839.)

4. Such structure, being lawfully authorized and constructed, Congress would have no right to take it or remove it without paying full compensation therefor, even though it were taken or removed for the purpose of improving a navigable stream. (U. S. *v.* Monongahela Nav. Co., 148 U. S., 312; U. S. *v.* Bellingham Boom Co., 176 U. S., 211; Pumpelly *v.* Green Bay Co., 13 Wall., 166; Scranton *v.* Wheeler, 179 U. S., 163; Hawkinspoint Light-House case, 39 Fed., 87; U. S. *v.* City of Moline, 82 Fed., 592.)

The undersigned, as receivers, do not wish to be understood that, under certain conditions, they would not be willing to petition the court which appointed them for authority to lower the aforesaid tunnel near Van Buren street; but, on the contrary, they have at all times been willing and now stand ready to request of the said court authority to lower said tunnel, provided they shall be able to come to some amicable arrangement with the city of Chicago with reference to their rights of occupancy in the streets of the city of Chicago, concerning which there is serious controversy between the undersigned and the authorities of the city of Chicago.

As to the tunnels at Washington and La Salle streets such rights of occupancy as the undersigned, as receivers as aforesaid, enjoy will be terminated, as claimed by the city of Chicago, aproximately in two years, and no justification can be conceived for incurring the enormous expense of lowering said tunnels with no guaranty or assurance whatever that, by the time of their completion, the undersigned, or their successors, will be able to enjoy them.

As to the tunnel near Van Buren street, the same will be of no value to the undersigned, or to their successors, when they shall no longer enjoy the privilege of operating their lines of railway in the city of Chicago over streets connecting with said tunnel.

Respectfully submitted.

JAMES H. ECKELS,
MARSHALL E. SAMPSELL,
JNO. C. FETZER,
Receivers Chicago Union Traction Company.

Mr. ISHAM RANDOLPH (chief engineer of the sanitary district). Is this a time for questions on the paper just read?

Colonel ERNST. Yes, sir.

Mr. ISHAM RANDOLPH. The statement was made there that they are the owners of the land on both sides of the river. Now I am not getting up to challenge that statement, but I am very much inclined to think that that is an error. They occupy the west side of the river under lease from the Pennsylvania Railroad Company, I think. We have had a great deal to do with that company at that point, and that lease has been shown to me, and my impression is that that property is under a lease from the Pennsylvania Company. If that is not the case, I think it ought to be cleared up.

Capt. J. G. KEITH. What do you know of the east side of the river?

Colonel ERNST. You will please address the Chair when you wish to speak, Captain Keith.

I would like to ask Mr. Artingstall in reference to a matter to which the letter just read does not seem to allude. What would be the effect on traffic over the tunnels during the time they were being lowered, while the work of taking off the roof, etc., making the channel over them, was going on?

Mr. ARTINGSTALL. The La Salle and Washington street tunnels, while the upper portion is being built, the traffic over the tunnels would have to be suspended in any case. As far as the Van Buren street tunnel is concerned, I think we can manage it without suspending traffic more than one or two months. There are two methods of doing the work; one is to build a new roof inside of the present one, if we have room enough——

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Colonel ERNST. I won't go into details as to the methods; you state in any case it will be necessary to suspend river traffic for two months?

Mr. ARTINGSTALL. Not river traffic—street traffic; the use of the tunnels.

Colonel ERNST. What would the receivers have to say to this proposition—that pending the solution of all these legal and engineering questions connected with the final adjustment of the tunnels to their new uses at the lower levels, the tunnels be abandoned for the present, and just take off the roofs?

Mr. ARTINGSTALL. I am sure I could not answer that question.

Colonel ERNST. So you are not prepared to answer that question?

Mr. ARTINGSTALL. I am not prepared to answer.

Colonel ERNST. That is all, Mr. Artingstall. Now, is the city ready?

Mr. TOLMAN (representing the city of Chicago). Perhaps, Colonel, it would be better for me to read this paper myself, as I have not had a chance to read it since it was typewritten.

Colonel ERNST. Very well; you may do so.

Mr. TOLMAN. May I read sitting?

Colonel ERNST. Yes; first let us know by whom it is signed.

Mr. TOLMAN. It is signed by the corporation counsel of the city of Chicago, written at the request of the mayor in answer to your letter to him.

Mr. Tolman then read the letter, which is as follows:

CITY OF CHICAGO,
OFFICE OF THE CORPORATION COUNSEL,
May 18, 1904.

Col. O. H. ERNST,
Corps of Engineers, U. S. A.

COLONEL: I am directed by the Hon. Carter H. Harrison, mayor of the city of Chicago, to present to you in writing such information with regard to the relation of the municipality and the various traction companies as may be pertinent to the consideration of the time within which the tunnels underneath the Chicago River should be removed or lowered.

You will permit me to observe at the outset that his honor the mayor desires the obstruction to commerce in the Chicago River removed at the earliest possible day, and I am directed not to ask for any delay in the enforcement of the act of Congress approved April 27, 1904, declaring the tunnels under the Chicago River at La Salle street, at Washington street, and near Van Buren street to be obstructions to navigation and to be removed or lowered.

It is my purpose, however, to present to you, and through you to the Secretary of War, all the facts which bear upon the question of the time to be fixed for the removal or alteration of the tunnels, in order that in the fixing of the time you and the Secretary of War may have an opportunity to consider how far the interests of the city and of the public may be affected.

I.—*Existing conditions and contract rights of the street car companies in the tunnels.*

(*a*) THE WASHINGTON STREET TUNNEL.

This tunnel was constructed by the city of Chicago and was and is owned by the city.

On February 1, 1886, an ordinance was passed granting to the Chicago Passenger Railway Company the right, among other things, to use the Washington street tunnel for a period of twenty years from the date of its passage. Section 4 thereof provides that "Nothing in this ordinance contained shall be construed as imposing any obligation or duty upon the city of Chicago concerning the repair or maintenance of said Washington street tunnel." Section 9 provides that the company shall indemnify and save the city of Chicago harmless from all costs, expenses, or damages in any way resulting from the passage of the ordinance, the granting of the privileges therein contained, and the exercise of said privileges, or any acts therewith connected, by the company, its servants, or agents.

On March 30, 1888, an amendatory ordinance was passed by the city council of the city of Chicago, granting authority to the Chicago Passenger Railway Company (among other things) to operate an underground cable line through said tunnel. Section 11 of said ordinance provided that the company should maintain the tunnel in good repair during the time it should use the same, and that

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if it should fail to do so, the city might repair the tunnel, whereupon the company should be under obligation to reimburse all moneys thus expended within thirty days after notice.

It will be observed that the right to use this tunnel terminates on March 8, 1906.

(*b*) THE LA SALLE STREET TUNNEL.

This tunnel also was constructed by the city of Chicago, and was and is owned by the city.

On July 19, 1886, an ordinance was passed by the city council authorizing the North Chicago Street Railroad Company to operate by cable power through the La Salle street tunnel and on certain other streets. This ordinance also was for a term of twenty years, and imposed on the company the duty to keep said tunnel in repair and indemnify the city substantially as provided in the ordinance for the Washington street tunnel.

It will be observed that the right of the street-car company to use this tunnel will expire on July 19, 1906.

(*c*) THE VAN BUREN STREET TUNNEL.

This tunnel was built by the West Chicago Street Railroad Company (through the agency of an intermediary tunnel company), under an ordinance passed April 2, 1888.

The ordinances above referred to are hereto attached, set out in full, and marked "Exhibits A, B, and C," respectively.

II.—*The effect of the removal of the tunnels on the transportation problem of the city of Chicago.*

I respectfully transmit herewith letter of John Ericson, city engineer, and make the same a part of this communication as Exhibit D. From this communication I think it will clearly appear—

First. That the permanent removal of the tunnels under the Chicago River will leave the city without adequate facilities for the transportation of its citizens and the carriage of its merchandise from the west and north divisions of the city of Chicago over the river by means of bridges to the business center.

Second. That during the period of reconstruction of the tunnels, if the same be lowered and reconstructed, serious doubt exists as to whether or not the present bridges are of adequate capacity to meet the demands of transportation, even for a temporary period, without serious inconvenience and damage, not only to those interests which use the streets, but to those interests also which use the river as a highway.

Upon these engineering questions I, of course, express no opinion whatever.

There are, however, certain legal questions to which I next briefly address myself, in order that you may be advised as to all elements bearing upon the question of the time to be fixed for the removal or reconstruction of the tunnels.

III.—*Pending litigation between the city of Chicago and the traction companies.*

(*a*) THE LITIGATION WITH REGARD TO THE LOWERING OF THE TUNNELS.

On July 12, 1900, the city of Chicago filed three petitions for mandamus in the circuit court of Cook County against the Chicago Union Traction Company and the West Chicago Street Railroad Company to compel the lowering of the Washington street tunnel; against the Chicago Union Traction Company and the North Chicago Street Railroad Company to compel the lowering of the La Salle street tunnel, and against the West Chicago Street Railroad Company to compel the lowering of the Van Buren street tunnel, in each case at the expense of the companies. Said cases were docketed as numbers 208875, 208878, and 208883, respectively. The last-mentioned case, the one involving the Van Buren street tunnel, was tried in the circuit court on April 27, 1901, and decided adversely to the city. The city prosecuted a writ of error to the appellate court of the first district of Illinois, where it was held, on January 16, 1903, that said court was without jurisdiction, on the ground that the appeal should have been taken to the supreme court as involving a freehold and franchise right of the street railroad company. This case was promptly appealed to the supreme court of

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Illinois, and on June 16, 1903, that court entered an order reversing the judgment of the appellate court and remanding the cause to the appellate court, with instructions to consider and decide the case upon the errors assigned. This case was accordingly redocketed in the appellate court. The city's brief and argument has been printed and filed, and a motion made to advance the case on account of the public interest involved. This motion at the present writing has not been decided, but a prompt decision of the controversy by the appellate court is expected, at least in time for further appeal to the supreme court at the next October term, where final decision of the matters in controversy can reasonably be expected by the end of the present year. In my opinion the decision of the supreme court upon the question of whether or not the case involved a freehold or franchise right of said companies is a complete victory for the city in its contention that it has the right to compel the occupants of these tunnels to alter or reconstruct the same whenever necessary to prevent any obstructions to commerce in the river. I attach a copy of said decision of the supreme court as Exhibit E and make the same a part hereof.

It has heretofore been thought advisable to delay the trial of the other cases until the Van Buren street case was decided, but in view of what seems to me to be the far-reaching and conclusive effect of the decision of the supreme court above referred to, I have directed the other two mandamus cases to be set down for trial at the earliest possible date, and hope to have all three cases before the supreme court together.

(*b*) LITIGATION WITH REGARD TO THE RIGHTS OF STREET OCCUPANCY BY THE COMPANIES USING SAID TUNNELS.

The Union Traction Company is the assignee or lessee of all the lines using or entitled to use said tunnels. The relations of said Union Traction Company to its so-called underlying companies are too complex to be stated within the limits of this communication. It is a matter of public knowledge that there has been for nearly forty years an irreconcilable controversy as to the duration of the rights of occupancy of the street railways in Chicago. The receivers of the Union Traction Company, on July 18, 1903, filed their so-called ancillary bills in the circuit court of the United States for the northern district of Illinois for the determination of their rights under the statutes of the State and the ordinances of the city. This case was brought to trial without delay, the course of proceedings having been expedited materially by the city. It has been fully argued, both orally and upon printed briefs, and an early decision of the controversy is expected. Unless the decision of the United States circuit court should be acquiesced in by both parties an appeal will be taken by the party aggrieved to the United States Supreme Court at the next October term. A case of such importance as this, involving, as it does, the public interests, would almost without question be advanced for argument, and a decision of these questions, which have vexed the community for more than a generation, might reasonably be expected during the coming winter—1904–5.

One of the most important controversies in this litigation is whether or not an act of the general assembly of the State of Illinois, passed February 6, 1865, commonly known as the ninety-nine-year act, extended the term of the street-railway ordinances of the city of Chicago, passed prior to the passage of said bill, or whether it merely ratified said ordinances and made them a part of the act as made and without amendment or extension; also whether the provisions of an ordinance purporting to grant on certain of said streets the right of occupancy for street-railway purposes until the city should purchase was so affected by said act that the time of purchase by the city was postponed. It is also a question at issue between the companies and the city whether, on the cable lines running through each of said tunnels, the companies had the right to substitute electricity for cable power, or are confined to operation thereof by cable, said cable lines being also lines concerning which both of the other controversies exist, to wit, whether or not the right of operation endures for ninety-nine years, and whether an immediate right of purchase on the part of the city exists. It will be apparent that the removal of the tunnels will prevent the operation by cable of the lines now so operated through said tunnels. The physical conditions are such that it will probably be impossible to operate any part of said lines in the business center by cable power. The duty of the city to furnish transportation for its citizens will probably compel granting of at least temporary permission to operate by electric power. If the tunnels be permanently removed and bridges substituted, the necessity will probably be for the grant of

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electric-power privileges for the balance of the period of operation, whatever that might be determined to be. Operation by cable power is not so profitable or valuable as operation by electricity. Any action which the city of Chicago should be compelled to take by the force of circumstances beyond its control (such as, for example, the immediate removal of the tunnels and the enforced substitution of electric power in place of cable power on all cable lines), which will result in appreciating the value of the ninety-nine-year act to the companies and increasing the price which the municipality might be compelled to pay for the purchase of the rights thereunder, if it should hereafter so elect, would, in advance of the final determination of the respective rights of the city and the companies, be highly prejudicial to the city of Chicago, and ought to be duly weighed as against the prejudicial results of the present location of the tunnels to the commerce of Chicago.

I attach hereto, as Exhibits F and G, respectively, plats [a] of the North and West Side Street Railway lines, showing which of said lines are operated by electricity, which by cable power, and the relation of each to said tunnels, together with the loops in the business center.

These considerations are presented for your information and that of the Secretary of War, in order that he may not inadvertently and in ignorance of the situation take such action as shall seriously prejudice the rights of the city of Chicago in its existing controversy with the street-railway companies, and with the suggestion that the facts above stated demonstrate that the coercive power of the Government, so far as controlled by the Secretary of War, ought to be directed to the companies occupying said tunnels and not to the city of Chicago.

IV.—*The statutory limitations on the power of the city of Chicago to expend money or make contracts.*

If the Secretary of War should be of the opinion that the necessities of commerce require the removal of said tunnels, as obstructions in said river, without regard to the question of whether the payment of the cost thereof should be borne by the taxpayers of the city of Chicago or by the companies using said tunnels, and if it should seem to the Secretary of War that the exigencies of the case require that the work should be done without waiting for a determination of any of the pending cases above referred to, which will or may be conclusive upon the questions involved, then and in such case I invite attention to sections 2 and 4 of Article VII of chapter 24 of the Revised Statutes of Illinois, an act entitled "An act to provide for the incorporation of cities and villages," in force July 1, 1872, and adopted by the city of Chicago, pursuant to law, April 23, 1875, which are as follows, to wit:

"SEC. 2. The city council of cities and board of trustees in villages shall, within the first quarter of each fiscal year, pass an ordinance, to be termed the annual appropriation bill, in which said corporate authorities may appropriate such sum or sums of money as may be deemed necessary to defray all necessary expenses and liabilities of such corporation; and any such ordinance shall specify the objects and purposes for which such appropriations are made and the amount appropriated for such object or purpose. No further appropriations shall be made at any other time within such fiscal year, unless the proposition to make each appropriation has been first sanctioned by a majority of the legal voters of such city or village, either by a petition signed by them, or at a general or special election duly called therefor."

"SEC. 4. No contract shall be hereafter made by the city council or board of trustees or any committee or member thereof; and no expense shall be incurred by any of the officers or departments of the corporation, whether the object of the expenditure shall have been ordered by the city council or board of trustees or not, unless an appropriation shall have been previously made concerning such expense, except as herein otherwise expressly provided."

Section 208 of the Criminal Code of Illinois makes a breach of this latter statute punishable by a fine not exceeding $10,000 and removal from office.

The annual appropriation bill for the year 1904 was made and passed on March 7, 1904, and contained no item for the removal or alteration of the tunnels under the Chicago River.

As explaining the reasons why the problem of tunnel removal or reconstruction has not heretofore been solved, permit me to call your attention also to the following observations:

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[a] Not printed.

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The constitution of the State of Illinois provides (art. 9, sec. 12) that no municipal corporation shall be allowed to become indebted in any manner or for any purpose to an amount, including existing indebtedness, in the aggregate exceeding 5 per cent on the value of taxable property therein, to be ascertained by the last assessment for State and county taxes, previous to the incurring of such indebtedness. On October 24, 1898, the supreme court of Illinois, considering this constitutional provision, and applying it to the facts so far as the financial condition of Chicago was concerned, held that the city of Chicago was indebted in excess of the constitutional limitations, and was therefore without power to borrow money or make a contract whereby it could become further indebted. (City of Chicago *v.* McDonald, 176 Ill., 404.)

Not until the 17th day of February, 1904, was the city relieved from the limitations thus placed upon its debt-incurring power, on which last-mentioned date the supreme court of Illinois, upon a full showing of the financial condition of the city of Chicago, held that the city was no longer indebted in excess of its constitutional limitations, but that it had a margin of debt-incurring power somewhat in excess of $4,000,000.

Promptly upon the rendition of this decision by the supreme court of Illinois, the question of using a part of this newly ascertained borrowing power for the solution of the tunnel question was discussed by the city authorities of the city of Chicago, and the council committee on local transportation, after consideration of the matter, have retained the services of George W. Jackson, C. E., to act with the city engineer, John Ericson, C. E., in drawing preliminary plans for presentation to said committee and to the city council, from which may be determined the relative desirability of various plans for the removal or alteration of the tunnels so that they may no longer obstruct commerce in the Chicago River. These engineers advise me that the preparation of such preliminary plans and the canvassing of various methods of accomplishing the result under consideration can not be safely estimated as requiring less than ninety days. So far as it becomes your duty to report to the Secretary of War definite plans for the alteration of said tunnels, it is most respectfully suggested that the result of the study and collaboration of the two engineers above mentioned may well be received and considered, and that, if the city of Chicago is to pay for the cost of the alteration of its present tunnels, that an expression of its preference as to the method to be pursued might with propriety be received and considered by yourself and by the Secretary of War, particularly in view of the fact that serious question exists, under the statutes above referred to, whether the city of Chicago can lawfully enter upon the actual work until after the passage of the next annual appropriation bill.

In conclusion, will you permit me to again emphasize the fact that the city of Chicago is not asking for delay in the removal of the obstructions to commerce from the Chicago River. The suggestions herewith submitted are with a view to facilitating and expediting the solution of the problem and putting the solution into practical operation. So far as the facts before submitted speak for delay, it is only for delay against the summary removal of the present tunnels before plans can be matured and carried into execution to provide for a substitute which shall meet the transportation demands of the city. Beyond this I am instructed to say that the present administration of the city of Chicago desires not delay, but expedition.

Very respectfully,

EDGAR B. TOLMAN,
Corporation Counsel.

At the close of the reading of the preceding letter by Mr. Tolman, that gentleman made the following remarks:

"This decision by the supreme court of Illinois, the latest utterance of that body, treats this question as mentioned in the last chapter of the receivers' communication, and decides it conclusively against them; that whatever ownership they have is subject under the law of Illinois, the organic law under which the corporation was organized, to the superior right of commerce in the river, and I call your attention to that decision particularly in answer to that part of the letter."

The exhibits referred to in the letter submitted by Mr. Tolman are as follows:

EXHIBIT A.

AN ORDINANCE granting authority to the Chicago Passenger Railway Company to lay down tracks on sundry streets and to use Washington street tunnel. (Passed February 1, 1886. Accepted March 8, 1886, as amended February 8, 1886.)

1. *Grant—term—route—fare. Be it ordained by the city council of the city of Chicago.* SEC. 1. That in consideration of the acceptance hereof, and the

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undertaking of the Chicago Passenger Railway Company to comply with the provisions herein contained, consent, permission, and authority are hereby granted to said company, its successors and assigns, to lay down, construct, maintain, and operate, for the period of twenty years from the passage hereof, a double or single track railway, with all necessary and convenient turnouts, turntables, sidetracks, and switches, in, upon, over, and along all the following-described parts of streets in the city of Chicago, namely: On North Ashland avenue, from North avenue to Erie street; on Erie street, from North Ashland avenue to North Center avenue; on North Center avenue, from Erie street to Austin avenue, and on Washington street, from Des Plaines street to Michigan avenue, including the tunnel under the Chicago River; said tracks to be connected at the intersection of Erie street with North Ashland avenue and North Center avenue. The tracks in the tunnel shall be so laid and the cars in passing through the tunnel so operated as not to delay unnecessarily public travel. The rate of fare for carrying passengers on said railway shall not exceed 5 cents for each passenger for any continuous travel of one trip.

2. *Tracks—how laid.* SEC. 2. The tracks of said railway shall not be elevated above the surface of the street, and shall be laid with modern improved rails, and in such manner that carriages and other vehicles can easily and freely cross the same at all points and in all directions without obstruction, and shall also be laid as near to the center of the street as practicable.

Section 1509 of The Municipal Code of Chicago of 1881 (sec. 1704–1897), shall not apply to the railway tracks herein authorized, but the rails to be used shall be satisfactory to the mayor, and shall be laid under his direction.

3. *Motive power—passenger traffic.* SEC. 3. The cars or carriages to be used on said railway shall be operated by animal power only, and shall be used for no other purposes than to carry passengers and their ordinary baggage.

4. *Street improvements and repairs.* SEC. 4. The said company, as to the parts of streets in and upon which its said railway may be laid, and as to said tunnel, shall keep 8 feet in width where a single track shall be laid, and 16 feet in width where a double track shall be laid, in good condition and repair during all the time to which the privileges hereby granted shall extend, in accordance with whatever order, ordinance, or regulation may be passed or adopted by the city council in relation to such repairing; and when any new improvement shall be ordered by the city council of the said streets, or any of them, the said railway company shall, in the manner which may be required by the owners of property fronting on said parts of streets, or any of them, make such new improvements for the width of 8 feet where a single track shall be laid and for the width of 16 feet where a double track shall be laid; and said company shall make, for the same width, any new improvement of the roadway of said tunnel as may be required by said city council; and if said company shall refuse or fail so to do, the same may be done by the city, and the company shall be liable to the city for the cost thereof. Nothing in this ordinance contained shall be construed as imposing any obligation or duty upon the city of Chicago concerning the repair or maintenance of said Washington street tunnel.

5. *Time of completion.* SEC. 5. The tracks in said parts of North Ashland avenue, Erie street, North Center avenue, and Washington street, herein authorized, shall be laid on or before July 1, 1888, and if the said company shall fail to complete said tracks within the said time, the rights and privileges hereby granted shall, as to said uncompleted tracks, cease and determine: *Provided*, That if the said company shall be restrained or prevented from proceeding with the work upon said railway tracks by the order or writ of any court of competent jurisdiction, the time during which said company may be so delayed shall be added to the time herein prescribed for the completion of said railway tracks. The city shall, however, have the right to intervene in any suit for an injunction to restrain the said company, as aforesaid, and move for the dissolution of the injunction, in case such suit shall be deemed collusive or for the purpose of delay or of extending the time for the completion of said tracks.

6. *Streets restored—when.* SEC. 6. When the right of said railway company to operate its railways on said parts of streets shall cease and determine, said company shall remove its tracks from said parts of streets and put the said parts of streets from which said tracks shall be removed in as good condition as the adjacent parts of said streets.

7. *Damages.* SEC. 7. The said Chicago Passenger Railway Company shall pay all damages to the owners of property abutting on the said parts of streets upon or over which its road may be constructed, which said owners may sustain by reason of the location or construction of said road.

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8. *License fee.* SEC. 8. The said Chicago Passenger Railway Company shall pay into the city treasury of the city of Chicago, for the use of said city, the sum of fifty (50) dollars, and no more, as an annual license fee for each and every car used by said company in the manner following: In computing the number of cars upon which said license charge may be imposed, thirteen round trips, when the car is used in the transportation of passengers, shall be taken as equivalent to one day's use of one car; one-thirteenth of such round trips during each quarter shall be divided by the number of days in such quarter; such quotient shall be the number of cars subject to such license fee. The president, or other chief officer of said company, shall, under oath, make report quarterly to the comptroller of the city of Chicago of the whole number of cars so run by said company, and at the same time pay to said comptroller twelve dollars and a half ($12.50) for each car, to be ascertained as above prescribed in this section. The first quarter shall begin on the first day upon which said company shall run a car or cars for the carriage of passengers.

9. *Indemnity clause.* SEC. 9. The said company shall forever indemnify and save harmless the city of Chicago against and from any and all legal damages, judgments, decrees, and costs, and expenses of the same, which it may suffer or which may be recovered or obtained against said city for or by reason of the granting of such privileges, or for or by reason of or growing out of or resulting from the passage of this ordinance, or any matter or thing connected therewith, or with the exercise by said company of the privileges hereby granted, or from any act or acts of said company, its servants or agents, under or by virtue of the provisions of this ordinance.

10. *Bond.* SEC. 10. The Chicago Passenger Railway Company shall execute to the city of Chicago a good and sufficient bond in the penal sum of ten thousand ($10,000) dollars, to be approved by the commissioner of public works, conditioned for the faithful observance and performance of the provisions and conditions of this ordinance on its part, to be observed and performed as aforesaid.

11. *When to take effect—acceptance.* SEC. 11. This ordinance shall take effect and be in force as soon as the said company shall file with the city clerk its formal acceptance of the same and its bond as hereinbefore prescribed: *Provided, however*, That if said acceptance and bond shall not be filed as aforesaid within ninety days from the passage hereof this ordinance shall be void and of no effect.

AN ORDINANCE granting authority to the Chicago Passenger Railway Company to operate its various lines by electric or cable power. (Passed March 30, 1888. Accepted April 21, 1888.)

1. *Change authorized—exception as to cable power. Be it ordained by the city council of the city of Chicago.* 1. That in consideration of the acceptance hereof and the undertaking of the Chicago Passenger Railway Company to comply with the provisions herein contained, permission and authority is hereby given to said company to construct, maintain, and operate its various lines of railways, or any of them, or any part thereof, by electric power or by stationary engine or engines not located on the public streets or public places on the streets, and propelled by other than animal power, and may connect its tracks with other street railroads. Nothing in this section or ordinance contained shall authorize the Chicago Passenger Railway Company, its lessees or assigns, to construct any cable system upon any street or streets that the city council of the city of Chicago has not heretofore authorized to be used by said Chicago Passenger Railway Company for street railway purposes, and not lost by non-user of forfeiture.

2. *Conditions.* SEC. 2. That the said Chicago Passenger Railway Company, or its lessees or assigns, may for said purposes make all needful and convenient trenches, excavations, and sewer connections, and may place all needful and convenient cables and machinery on any streets upon which its railways are now constructed or authorized by ordinance to be constructed; such cables and machinery shall be underground, and constructed in a substantial and workmanlike manner of the most approved method and convenience so as not to interfere with public travel: *Provided*, That if in the constructing said trenches and excavations, or using the same, any damage or injury shall result to any of the sewers, water pipes, or private drains, then the said company shall pay and be held liable therefor; and if at any time, by reason of the permission hereby granted and the making of said trenches or running said cables, any injury or damage shall result to any person or property, then said company shall be held

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liable therefor; and said company shall pay all damages to the owners of property abutting upon roads, streets, highways, or public property upon or over which its said road is to be constructed, which said owners may sustain by reason of the location or construction of said company's road. And all needful and convenient connections with the motive power or engines shall be subject to the same conditions and restrictions: *And provided further*, That the aperture opening into the said trenches shall not exceed five-eighths of an inch in width: *And provided further*, That the said Chicago Passenger Railway may operate not exceeding two cars and one grappling car attached together, with one driver in charge of the grip car and one conductor in charge of each additional car.

3. *Tracks, how laid.* SEC. 3. The tracks of said railway shall not be elevated in said streets above the surface of the streets, and shall be laid with modern improved rails in such manner that carriages and other vehicles can easily and freely cross the same at all points and in all directions without obstruction. The rails to be used in the construction of said tracks shall be satisfactory to the mayor and commissioner of public works. Each of said tracks shall be laid as near the center of said street as practicable, and shall not be laid within twelve (12) feet of the sidewalk in any place, except in turning street corners or constructing curves, and there no nearer than may be required to make the necessary curve; and the cars to be constructed with all the latest improvements for the comfort and convenience of passengers, and shall be used for no other purpose than for the transportation of passengers. Animal power may be used to move the cars.

4. *Speed regulations.* SEC. 4. The city council shall have power at all times to make such regulations as to the rate of speed on said streets as the public safety and convenience may require.

5. *License fee.* SEC. 5. The said Chicago Passenger Railway Company shall pay into the city treasury of said city the sum of fifty dollars ($50) as a license fee for each and every car used by said company on the railways hereby authorized, which has not been included for license fees for use on other lines. The number of cars upon which license shall be imposed shall be determined, and the license fee paid in the same manner as provided in an ordinance entitled "An ordinance concerning street railways in the city of Chicago," passed July 30, 1883, and approved by the mayor August 6, 1883.

6. *Removal of tracks.* SEC. 6. When the right of said company to operate its said railway upon said streets shall cease, said company shall remove its tracks from the same and place the same in as good condition as when said tracks were laid.

7. *Bond.* SEC. 7. The Chicago Passenger Railway Company shall enter into a good and sufficient bond with the city of Chicago in the penal sum of one hundred thousand dollars ($100,000) for the faithful performance of all the terms and conditions in this ordinance contained.

8. *Indemnity clause.* SEC. 8. The said company shall forever indemnify and save harmless the city of Chicago against and from any and all legal damages, judgments, decrees, and costs, and expenses of the same, which it may suffer or which may be recovered or obtained against said city for or by reason of the granting of such privileges, or for or by reason of or growing out of or resulting from the passage of this ordinance, or any matter or thing connected therewith, or with the exercise by said company of the privileges hereby granted, or from any acts of said company, its servants or agents, under or by virtue of the provisions of this ordinance.

9. *Term of grant unchanged.* SEC. 9. The permission and authority hereby conferred are given upon the express understanding and agreement that the provisions of this ordinance shall and does not extend the time during which the said Chicago Passenger Railway Company may operate its lines upon the streets of Chicago. The said privileges are to be governed in this respect by ordinances heretofore passed.

10. *Subject to ordinances.* SEC. 10. Unless otherwise provided in this ordinance, the privileges hereby granted are subject to all the general ordinances of the city of Chicago now in force or which may be passed in reference to horse railways or street railways, and to all ordinances affecting the lines of railways of which the lines hereby authorized are extensions.

11. *Tunnel extension—power of counsel.* SEC. 11. The said company, in operating its cable line through the tunnel at Washington street, shall be governed by the provisions of the ordinance passed February 1, 1886, as amended by ordinance passed February 8, 1886, relative to the use of such tunnel by said

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company, so far as the same are not inconsistent herewith, and also to the provisions of this section. The time for laying the tracks through such tunnel, as determined by said ordinance of February 1, 1886, shall be deferred until said company shall have first rebuilt and repaired the tunnel in accordance with plans to be approved by the commissioner of public works and under the supervision of said commissioner. The said company shall pave the entire roadway from end to end with stone, or such other materials as may be agreed upon by said company and said commissioner; and said company shall provide and operate suitable engines and machinery for lighting and ventilating said tunnel and keeping the same free from water, and it shall, during the use of said tunnel, keep the same well lighted and ventilated and free from water. The said company shall also keep the walls of said tunnel whitened, and shall maintain the tunnel in good repair during the time it shall use the same. The said company shall at its own expense pave, maintain, and keep paved and in good order the whole of the roadway through said tunnel.

Both the tram rails and the slot rails used in said tunnel shall first be approved by the mayor and commissioner of public works, and shall be laid to their satisfaction. Said company shall not run its cars through said tunnel at a speed greater than four miles per hour. The city council reserves the right to change or regulate such speed, but the same shall not be so increased as to exclude the use of said tunnel by vehicles other than the street cars, and whenever a carriage, wagon, or other vehicle shall be in front of a car passing through said tunnel on the up grade, then the speed of said car shall be governed by the speed of such carriage, wagon, or vehicle: *Provided, however*, That it shall be the duty of the driver of such carriage, wagon, or other vehicle to exercise a reasonable diligence, so as to not unnecessarily delay such car, it being expressly understood that the Chicago Passenger Railway Company shall, during its occupancy of said tunnel, maintain and keep the said tunnel in repair, and in the event it shall fail so to do, the city may repair the tunnel and the said railway company shall pay, upon thirty days' notice, all moneys so expended or expenses incurred by said city.

12. *Style of cars—heating.* SEC. 12. The said company shall also provide, upon all lines operated under this ordinance, cars of the most modern, approved fashion, of a kind equal to the best cars in use upon any cable road now in operation; and said company shall provide the best and most approved method for heating said cars, so that the same shall be kept properly heated at all times during cold weather.

13. *When in force—acceptance.* SEC. 13. This ordinance shall take effect and be in force as soon as the same shall have been duly accepted by said company and the said company shall have executed and filed with the city clerk the bond provided for herein, in the manner and form as hereinbefore required: *Provided, however*, That unless this ordinance shall be duly accepted and said bond executed and filed within ninety days of the passage hereof this ordinance shall be null and void.

EXHIBIT B.

AN ORDINANCE authorizing the North Chicago Street Railroad Company to operate by cable power through the La Salle street tunnel and on streets in the South Division. (Passed July 19, 1886. Accepted October 11, 1886.)

PAR. 1. *Cable road authorized. Be it ordained by the city council of the city of Chicago.* SEC. 1. That in consideration of the acceptance hereof and the undertaking of the North Chicago Street Railroad Company to comply with the provisions herein contained, permission and authority is hereby given to said company to construct, maintain, and operate a double-track street railroad on Illinois street, between Clark and Wells streets, and on La Salle avenue and La Salle street, through the La Salle street tunnel, from Illinois to Jackson street, and to operate the same by stationary engines not located upon the streets or public places of the city, upon the terms and conditions, and subject to the restrictions mentioned in this ordinance, and for that purpose to make all needful and convenient trenches, excavations, and sewer connections, and to place all needful and convenient endless cables and machinery on said streets so that such cables and machinery shall be under ground and not interfere with public travel, such right to be in force for the period of twenty years after the passage of this ordinance. And said company may make all necessary side tracks, turnouts, curves, switches, and connections with other street railway tracks, which may be intersected by said company in laying said tracks, and may connect its

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tracks on Illinois street with the tracks laid by the North Chicago City Railway Company, and operate the same herewith: *Provided*, That if, in constructing said trenches and excavations, or using the same, any damage or injury shall result to any of the sewers, water pipes, or private drains, then the said company shall pay and be held liable therefor; and if at any time, by reason of the permission hereby granted and the making of said trenches or running said cables, any injury or damage shall result to any person or property, then said company shall be held liable therefor, and said company shall pay all damages to the owners of property abutting upon roads, streets, highways, or public property upon or over which its said road is to be constructed which said owners may sustain by reason of the location or construction of said company's road. And all needful and convenient connections with the motive power or engines shall be subject to the same conditions and restrictions: *And provided further*, That the aperture opening into the said trenches shall not exceed five-eighths of an inch in width: *And provided further*, That said North Chicago Street Railroad Company may operate not exceeding two cars and one grappling car attached together, with one driver in charge of the grip car, and one conductor in charge of each additional car.

PAR. 2. *Tracks required—fare, etc.* SEC. 2. The tracks of said railway shall not be elevated in said streets above the surface of the streets, and shall be laid with modern improved rails in such manner that carriages and other vehicles can easily and freely cross the same at all points and in all directions without obstruction.

Section 1509 (sec. 1704–1897) of the Municipal Code of Chicago, of 1881, shall not apply to the said railway tracks herein authorized; but the rails to be used shall be satisfactory to the mayor and commissioner of public works. Each of said tracks shall be laid as near the center of the street as practicable, and shall not be laid within twelve feet of the sidewalk in any place, except in turning street corners or constructing curves, and then no nearer than may be required to make the necessary curve; and the cars shall be constructed with all the latest improvements for the comfort and convenience of passengers, and shall be used for no other purpose than for the transportation of passengers. Animal power may be used to move the cars. The rate of fare shall not exceed five cents for each passenger for any continuous travel at one ride over said tracks and the tracks laid by the North Chicago City Railway Company.

PAR. 3. *Time limited, forfeiture, etc.* SEC. 3. The tracks herein authorized shall be completed before the first day of November, A. D. 1887: *Provided*, That if the said company shall be delayed, by the writ of injunction of any court, from proceeding with the work, the time of such delay shall be excluded from the time provided herein for the completing of said tracks: *Provided, however*, That the city law department may intervene in any such suit and move for the dissolution of such injunction in case such suit may be deemed by such law department as collusive or for the purpose of delay or extension of such time. And if the said company shall fail to complete the tracks within the time mentioned herein, the rights and privileges hereby granted shall cease and determine.

PAR. 4. *Street improvements, etc.* SEC. 4. The said company, as to the parts of streets in and upon which its said railway may be laid, shall keep 8 feet in width where a single track shall be laid, and 16 feet in width where a double track shall be laid, in good condition and repair during all the time to which the privileges hereby granted shall be extended, in accordance with whatever order, ordinance or regulation may be passed or adopted by the city council in relation to such repairing, and when any new improvement shall be ordered, by the city council, of the said streets, or any of them, the said railway company shall, in the manner which may be required of the owners of property fronting on said parts of streets, or any of them, make such new improvements for the width of 8 feet where a single track shall be laid, and for the width of 16 feet where a double track shall be laid; and said company shall make any new improvement of the roadway of said tunnel as may be required by said council; and, if said company shall refuse or fail so to do, the same may be done by the city, and the company shall be liable to the city for the cost thereof. Nothing in this ordinance shall be construed as imposing any obligations or duty upon the city of Chicago concerning the repair or maintenance of said La Salle street tunnel.

PAR. 5. *$25,000 per annum license fee unless bridges are built, etc.* SEC. 5. The said North Chicago Street Railroad Company shall pay to the city of Chicago, as a fee for the license or permission to lay its cables and tracks and run its cars through said La Salle street tunnel, the sum of $25,000 per annum,

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payable semiannually on the first days of January and July of each year during the time said tunnel is used by said company, the time to commence when said company shall begin to dig its trenches or lay its tracks through said tunnel: *Provided, however*, That if said company shall pay into the city treasury, or arrange to the satisfaction of the mayor and city comptroller for such payment, an amount of money sufficient to defray the entire expense of erecting a new 4-track iron bridge, similar to those at Rush and Lake streets, the same to be operated by steam power, over the Chicago River at Clark street, in lieu of the present bridge at that point, then said annual license fee shall be reduced to the sum of $10,000 per annum, from and after the payment of said expenses into the city treasury, or if said expense be arranged for as aforesaid, but not paid in advance, then from and after the commencement of the construction of said bridge. Before said rebate shall be allowed the said company shall secure the consent of the abutting property owners to the erection and swinging of said bridge in perpetuity: *Provided, further*, That if said company shall also pay into the city treasury, or arrange for said payment in the manner hereinbefore mentioned, an amount of money sufficient to defray the entire expense of erecting a similar 4-track iron bridge, to be operated by steam power, over the Chicago River at Wells street and Fifth avenue, in lieu of the present bridge at that point, then said annual license fee shall cease to be paid, from and after the time when said expense is advanced to the city, or, if arranged for as aforesaid and not advanced, then from and after the commencement of the construction of said last-mentioned bridge. The expense of erecting said bridges, and each of them, shall also include the cost of all necessary piers, abutments, engines, and machinery, and the same shall be built from plans to be prepared by, and under the supervision of, the commissioner of public works. Such plans to be prepared by said commissioner within ninety days after the acceptance of this ordinance by said company. It is hereby declared that said bridges shall not be constructed at the same time, nor either of them, while said tunnel shall be closed for the building of said trenches or the laying of said tracks therein. The said company may, however, elect as to which of said bridges shall be first constructed; but the abatements hereinabove named from said license fee of $25,000 shall be made for each of said bridges, to wit: $10,000 for said bridge at Wells street and Fifth avenue, and $15,000 for the bridge at Clark street, in accordance with the provisions therefor hereinbefore stated. For any failure to comply with the provisions of this section this ordinance shall be subject to repeal.

PAR. 6. *Improvements and repairs to and in the tunnel.* SEC. 6. The said company shall pave the entire roadway of said tunnel, from end to end, with stone or such other material as may be agreed upon by said company and the commissioner of public works; and said company shall provide proper engine or engines, boilers, and machinery with which to light and ventilate said tunnel and pump the water from the roadway thereof, using the present engine-station ground for the same, as far as practicable, and shall, during the use of said tunnel, light the same, including the footway, in the best manner, and shall keep the said tunnel and its passageways free from water and well ventilated.

The said company shall also keep the walls of the carriage way and footway wall well painted and maintain the tunnel in good repair during the time it shall use the same. The said company shall, at its own expense, pave, maintain, and keep paved and in good order the whole of the roadway through said tunnel. The rails to be used in the tunnel shall be a grooved rail, having a flat surface, and so laid that the surface on both edges shall be flush with the pavement, the groove being for the flange of the wheel to run in. The bands, or "Z iron," which protect the slot or aperture opening into the trenches, shall be corrugated, or shall have a rough surface, so as to prevent horses from slipping thereon; such rails and bands to be approved of by the mayor and commissioner of public works and to be laid to their satisfaction. Said company shall not be permitted to and shall not run any of its cars at a speed greater than 4 miles per hour, and whenever a carriage, wagon, or other vehicle shall be in front of a car passing through said tunnel on the upgrade, then the speed of said car shall be governed by the speed of such carriage, wagon, or vehicle: *Provided, however*, That it shall be the duty of the driver of such carriage, wagon, or other vehicle to exercise reasonable diligence so as not to unnecessarily delay such car. The city council may, at any time, change or regulate the speed of the cars passing through said tunnel, but no such regulation shall so increase the speed above named as thereby to exclude the use of said tunnel by vehicles other than the street cars.

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PAR. 7. *Rate of speed and running time may be regulated.* SEC. 7. The city council shall have power at all times to make such regulations as to the rate of speed on said streets and time or times of running said cars or carriages as the public safety and convenience may require.

PAR. 8. *License fee $50 per car.* SEC. 8. The provisions of section 1 of an ordinance entitled "An ordinance concerning the street railways in the city of Chicago," passed July 30, 1883, and the license fee of $50 per car as therein imposed shall extend to the cars to be run on the railway hereby authorized: *Provided*, That but one license fee shall be charged for cars over the lines of said company in connection with the lines of the North Chicago City Railway Company.

PAR. 9. *Removal of snow.* SEC. 9. The said company shall not place, or cause to be placed, outside of its tracks upon the roadway of said streets, or either of them, the snow which may fall upon said tracks, except upon the condition that the same be removed therefrom by said company within eighteen hours after the cessation of such snowfall. Said tunnel shall at all times be kept free from snow.

PAR. 10. *Tracks, etc., to be removed, when.* SEC. 10. When the right of said company to operate its said railway upon said streets and in said tunnel shall cease, said company shall remove its tracks from the same and place the same in as good condition as when said tracks were laid.

PAR. 11. *Bond.* SEC. 11. The said North Chicago Street Railroad Company shall enter into a good and sufficient bond with the city of Chicago, with sureties satisfactory to the mayor, in the penal sum of $50,000, for the faithful performance of all the terms and conditions contained in this ordinance, and that said railway herein mentioned shall be completed at the times and manner herein stated, unless delayed by order of court, as provided by section 3 of this ordinance.

PAR. 12. *When in force.* SEC. 12. This ordinance shall take effect and be in force as soon as the same shall have been duly accepted by said company, and the said company shall have executed and filed with the city clerk the bond provided for herein, in manner and form as hereinbefore required: *Provided, however*, That unless this ordinance shall be duly accepted and said bond executed and filed within ninety days of the passage hereof, this ordinance shall be null and void.

NOTE.—See three following amendatory ordinances.

AN ORDINANCE changing and modifying ordinance of July 19, 1886, as to tracks of the North Chicago Street Railroad Company in La Salle street. (Passed July 6, 1887.)

Preamble. Whereas the North Chicago Street Railroad Company acquired the right, by an ordinance passed July 19, 1886, to construct a street railroad on certain streets named in said ordinance, and said company has laid its double tracks on La Salle street, from Washington street to Monroe street, and is about to continue the same from Monroe street to Jackson street; and

Whereas the property owners on La Salle street are anxious that only a single track shall be laid at present on La Salle street, from Randolph street to Monroe street, and that no track shall now be laid south of Monroe street, and said company is willing to temporarily remove one of its present tracks on La Salle street, between Washington street and Monroe street, and also to postpone the laying of its tracks on La Salle street south of Monroe street, upon condition that said company shall have and possess all the rights as granted by said ordinance of July 19, 1886: Therefore,

PAR. 1. *Modification of grant. Be it ordained by the city council of the city of Chicago.* SEC. 1. That the time for the completion of the tracks of the North Chicago Street Railroad Company upon La Salle street, as authorized by the ordinance of July 19, 1886, is hereby extended until November 1, 1888: *Provided*, That the second track laid by said company upon La Salle street, between Washington street and Monroe street, shall be removed by said company within ten (10) days from the taking effect of this ordinance: *And provided also*, That all the grants to said company, as specified in said ordinance of July 19, 1886, shall be and remain vested in said company, upon the conditions mentioned in such ordinance.

AN ORDINANCE amending ordinance of July 19, 1886, to the North Chicago Street Railroad Company. (Passed October 5, 1888.)

PAR. 1. *Amendment—rebate—consent. Be it ordained by the city council of the city of Chicago.* SEC. 1. That the ordinance passed by the city council July

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19, 1886, granting permission to the North Chicago Street Railroad Company to construct a street railroad on Illinois street, and on La Salle avenue and La Salle street, through the La Salle street tunnel, be, and the same is hereby, amended by striking out from section 5 of said ordinance the following sentence: "Before said rebate shall be allowed, the said company shall secure the consent of the abutting property owners to the erection and swinging of said bridge in perpetuity."

PAR. 2. *When effectual.* SEC. 2. This ordinance shall take effect and be in force from and after its passage.

AN ORDINANCE granting a further extension of time to the North Chicago Street Railroad Company to lay tracks on La Salle street. (Under ordinance of July 19, 1886.) (Passed October 15, 1888.)

PAR. 1. *Extension of time. Be it ordained by the city council of the city of Chicago.* SEC. 1. That the time for the completion of the tracks of the North Chicago Street Railroad Company upon La Salle street, as authorized by the ordinance of July 19, 1886, and amended by the ordinance of July 6, 1887, be, and the same is hereby, extended until such time as the council shall order the laying and completion of the said tracks.

PAR. 2. *In force, when.* SEC. 2. This ordinance shall be in force and effect from and after the date of its passage.

EXHIBIT C.

AN ORDINANCE AND RESOLUTION concerning an agreement between the West Chicago Street Railroad and the city of Chicago concerning an agreement for a tunnel under the river. (Passed April 2, 1888.)

1. Preamble. Whereas the board of directors of the West Chicago Street Railroad Company on the 2d day of April, 1888, by and at the request of the mayor of the city of Chicago, adopted the following resolution:

2. *Tunnel under river. Resolved,* That the West Chicago Street Railroad Company, in consideration of the passage and approval by the mayor of the three ordinances passed by the city council of Chicago on the 30th day of March, 1888—one granting to the West Division Railway Company the right to change its motive power from horse to cable or electric power; one granting to the Chicago Passenger Railway Company the right to make the same change, and one granting to the West Chicago Street Railroad Company the right to construct its tracks on Jefferson street, between Madison and Washington streets, and to use horse, cable, or electric power thereon—hereby agrees by and with the city of Chicago at its own expense to construct a tunnel under the Chicago River and acquire the necessary right of way therefor on a route to be located by said company between Madison and Twelfth streets, with the east terminus at Fifth avenue, or west thereof, and the western terminus at Halsted street, or east thereof: *Provided, however,* That this company shall have the right from said city to construct said tunnel under any intervening street or streets and said river within said limits, but such location and construction shall be such as not to interfere with the capacity, usefulness, or grade of said streets. Said tunnel to be used by this company for street railroad tracks, and the construction thereof shall be commenced within three years and be completed within four years after the said city council shall grant permission to said railroad company to make said improvements unless prevented by injunctions or strikes, and the time said construction is so interfered with shall be added to said four years, all work to be done in a manner satisfactory to the commissioner of public works, and the tracks through the tunnel shall be connected with the street railroad tracks controlled by this company.

Now, therefore, be it ordained by the city council, that the agreement in said resolution contained be, and the same is hereby, accepted by and on behalf of the city of Chicago as a consideration from said company for the passage and approval by the mayor of the ordinances in said resolution specified, and authority is hereby granted said company to make the improvements therein mentioned.

EXHIBIT D.

MAY 17, 1904.

Maj. EDGAR B. TOLMAN, *Corporation Counsel.*

DEAR SIR: Pursuant to your request to prepare a statement as to the practicability of providing for street-car transportation from the north and west sides

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of the city over bridges, should it be decided to lower or remove the present transportation tunnels at La Salle street, Washington street, and Van Buren street; also to express an opinion as to the length of time that would probably be required to reconstruct these tunnels at a lower grade, owing to the limited time I have been unable to collect such data and other information as would be desirable and the subject therefore has been treated only in a general way. The question of routing of the cars after leaving the bridges has not been considered.

The lowering of the tunnels and the necessity of closing them to traffic pending the completion of the work would necessitate the selection of routes for the street-car lines now going through the tunnels across bridges in order to accommodate the public. At the same time the accommodation of the team traffic and the navigation interests must be considered. In all these cases the electric system of propulsion must be substituted for the cable system.

LA SALLE STREET TUNNEL.

This tunnel is used by the following cable lines: City limits (Clark street), trains every four minutes; city limits (Wells street), trains every eight minutes; Lincoln avenue, trains every eight minutes; Clybourn avenue, trains every seven minutes.

As a cable train generally consists of a grip car and two trailers, and assuming that two single electric cars are equal as to seating capacity to one cable train, the traffic now going through the tunnel would be equal to one electric car about every minute. To take care of these north side lines the following bridges are available: Wells street bridge, Clark street bridge, Dearborn street bridge, and State street bridge. The Dearborn street bridge is old, dilapidated, and will probably be removed in a few months, to be replaced by a modern structure, the completion of which will require nearly two years. The Wells, Clark, and State street bridges are in good condition. If the work on the tunnels is commenced before the new Dearborn street bridge is completed the traffic will therefore have to be divided between the remaining three. Taking into consideration the hour of maximum traffic, morning or evening, and the present street-car traffic over these bridges, the effect on the general traffic is obvious.

WASHINGTON STREET TUNNEL.

The following cable lines pass through this tunnel: Milwaukee avenue, trains every six minutes; Madison street, trains every three minutes, or say one train every two minutes, the conditions in reference to amount of traffic being practically the same as the La Salle street tunnel.

The following bridges are available for this traffic, should the Washington street tunnel be closed: The Madison street, the Randolph street, and the Lake street bridges. The Lake street bridge is occupied by the Lake Street Elevated Railroad, with columns in the center of the roadway on the west side of the river, and the approaches are steep. The present street-car and other traffic over this bridge is also quite heavy, which, with the removal of the Washington street bridge, will most likely increase. It is therefore to be assumed that the bulk of the street-car traffic would go to the Madison and the Randolph street bridges. Both these bridges are in good condition, but relative to congestion of the traffic the conditions will be about the same as at the north-side bridges.

VAN BUREN STREET TUNNEL.

Through this tunnel runs only the Blue Island avenue cable line with trains every five minutes. To accommodate this traffic the Van Buren street bridge is most available, or Adams street bridge in case of emergency. A partial reconstruction of the floor system on the fixed and movable parts of the Van Buren street bridge and the substitution of heavier rails will be necessary in order to safely carry the additional traffic.

It will thus be seen that while the traffic can probably be taken care of the public will be inconvenienced to a considerable extent.

The marine interests which, in my opinion, are diverted from this harbor on account of the increased current in the river in connection with the many bridges which cause delays and difficulties, as much as on account of the obstructions caused by the tunnels, will be still more diverted.

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It should also be borne in mind that should one or more of the bridges referred to above be disabled the difficulty in handling the traffic would be correspondingly increased.

To destroy the tunnels and to permanently provide for the street-car traffic over bridges, therefore, in my opinion, is out of the question.

As to the time required to reconstruct either one of the tunnels under discussion it can hardly be more than a guess until it has been determined, first, what general plans are to be adopted, and, second, what will be the maximum required depth of the river for navigation purposes.

Assuming these points to have been determined and detail plans prepared, I am of the opinion that the work of reconstructing either of the tunnels will require not less than eighteen months' time.

Yours, truly,

JOHN ERICSON,
City Engineer.

EXHIBIT E.

At a supreme court, begun and held at Springfield on Tuesday, the 2d day of June, in the year of our Lord 1903, within and for the State of Illinois. Present: John P. Hand, chief justice; Jacob W. Wilkin, justice; James H. Cartwright, justice; Benjamin D. Magruder, justice; Joseph N. Carter, justice; Carroll C. Boggs, justice; James B. Ricks, justice; Howland J. Hamlin, attorney-general; Benjamin H. Brainerd, sheriff. Attest: Christopher Mamer, clerk.

Be it remembered that afterwards, to wit, on the 16th day of June, 1903, the opinion of the court was filed in the words and figures following, to wit:

The People ex rel. *v.* West Chicago Street Ry. Co. Error to appeal from first district. No. 3061, April, 1903.

Mr. Justice CARTWRIGHT delivered the opinion of the court:

The city of Chicago filed in the circuit court of Cook County its petition for a writ of mandamus directed to the West Chicago Street Railroad Company, commanding said company, at its own cost and expense, to lower its tunnel under the South Branch of the Chicago River, at on near Van Buren street, so as to provide for a clear depth of at least 21 feet of water above said tunnel at all times between the existing dock walls or to remove said tunnel, so that the same shall cease to be an obstruction to the free navigation of said river. The defendant answered the petition, and replications were filed raising issues of fact. A jury having been waived, the issues were submitted to the court for trial. The court found the issues for the defendant, denied the writ, and entered judgment against the relator for costs. The city of Chicago sued out a writ of error from the appellate court for the first district to review the judgment of the circuit court. The case was assigned to the branch of that court, which dismissed the writ of error for want of jurisdiction and entered judgment for costs against the city of Chicago. This appeal is from the judgment of the branch appellate court dismissing the writ.

The error assigned is that the appellate court erred in dismissing the writ of error for want of jurisdiction. The only question, therefore, is whether the appellate court had jurisdiction to hear and determine the errors assigned in that court. Whether the circuit court committed any error for which its judgment should be reversed is not involved.

It is first contended that the case involves a freehold, and that therefore the appellate court was without jurisdiction to review the judgment. The petition sets out that the city of Chicago is a municipal corporation organized under the general act for the incorporation of cities and villages; that within its territorial limits is the Chicago River, a navigable stream having its natural outlet in Lake Michigan; that the West Chicago Street Railroad Company is a corporation organized under the laws of this State, operating lines of street railroad in said city; that on April 2, 1888, the city council adopted a resolution permitting said company to construct, at its own expense, the tunnel under the Chicago River for the use of its street railroad; that the tunnel was completed by said company in March, 1894; that the water over the tunnel varied in depth from 17 to 18.3 feet; that since the building of the tunnel there has been an increase in the size of the vessels used in lake transportation, so that it has become necessary, for the proper use and navigation of the river, to deepen the channel; that the Congress of the United States, on March 3, 1899, passed an act for deepening the same to a depth of 21 feet, provided that the

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work of removing and reconstructing bridges and piers and lowering tunnels to permit a practical channel with such depth should be done or caused to be done by the city of Chicago without expense to the United States; that said city has passed an ordinance ordering and directing said company, at its sole cost and expense, to lower the tunnel as prayed for in the petition, and upon demand said company has refused to do so. The fifth paragraph of the answer alleges that the defendant is the owner of the land under the river in which the tunnel is situated and that the approaches to said tunnel on each side lie wholly on land owned by the defendant. The averments of said paragraph are not denied by replication and are therefore admitted. (Mayor of Roodhouse *v.* Briggs, 194 Ill., 435.) It is admitted on the record that the street-railroad company is the riparian owner of both sides of the river at the place where the tunnel was constructed, and therefore owns the soil under the river, and that the tunnel was wholly constructed in its land under the bed of the river. A freehold is only involved where the result of the litigation must be that one party will gain and another lose a freehold estate or where the title is so put in issue by the pleadings that a decision of the case necessarily involves a decision as to the title. The title to the freehold is not put in issue by the pleadings in this case, in which the title of the railroad company is admitted, and the city can not gain a freehold estate nor the railroad company lose such an estate as a result of the litigation.

The fact that the title is in the railroad company and that the tunnel was rightfully constructed in the first instance by that company under its charter and in pursuance of a license from the city is admitted. It seems to be claimed, however, that the purpose of the suit is to deprive the railroad company of the full, absolute, and exclusive enjoyment of the soil under the bed of the river as it now exists, and that therefore the freehold is involved. It is said that if the freehold is not involved in requiring the company to lower its tunnel 4 feet and deprive it of the use of 4 feet of soil under the river, it would not be involved in requiring it to lower the tunnel to a much greater depth. That is undoubtedly true, and upon this question the depth to which it is sought to have the tunnel lowered is not material. The question, however, is whether the railroad company is obstructing an easement to which its freehold is subject by interrupting navigation. It does not dispute the proposition that its freehold is subject to the public right of navigation of the river, and its freehold is not involved in the question whether it is obstructing the paramount right of navigation. It is a street-railroad corporation, claiming the right to build the tunnel by virtue of section 1 of the act in relation to street railroads under which it was organized. That section provides that a street-railroad company "may, subject to the provisions contained in this act, locate and construct its road upon and over any street, alley, road, or highway, or across or over any waters in this State, in such manner as not to unnecessarily obstruct the public use of such street, alley, road, or highway, or interrupt the navigation of such waters." (Hurd's Stat., 1899, p. 1683.) It was by virtue of that act and a license from the city of Chicago that the tunnel was constructed. The company could only acquire and hold the lands on each side of the river for the purposes of its incorporation, and it acquired such lands, carrying with them the soil under the river, subject to the easement of the public for the purposes of navigation. It could only exercise its chartered power to build the tunnel and carry its street railroad under the river upon the express condition contained in its charter that it should not interrupt navigation. The city claims no right to require the tunnel to be lowered unless it is an obstruction to the paramount public right of navigation, to which the company concedes, as it must concede, that the freehold in the soil is subject. It is true that, as against a private individual, material taken from the bed of the river belongs to the riparian owner, and he may maintain replevin from a trespasser or wrongdoer. (Braxon *v.* Bressler, 64 Ill., 488.) But the question whether the railroad company would own the soil taken from the bottom of the river in deepening it is not involved in this case. The public have a right to enjoy the free and uninterrupted navigation of the river, unobstructed by anything which will materially impair such use. The ownership of the soil under the river is subject to the public easement and the necessary incidental right to keep the channel fit for navigation. The question whether the public authorities in dredging the river would have a right to appropriate the soil removed from the bed of the river to their own uses is not to be decided in this suit.

It is next argued that the suit involves a freehold because the public easement of navigation is involved. Counsel say that while the land under the river is

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subject to the easement of navigation, such easement stops at the regular bed of the stream as it now exists. The decision of that question would not result in one party gaining and the other losing the easement of navigation. The case is not like one where the existence of a perpetual easement is asserted on the one hand and denied on the other, but it is admitted that the easement exists, and the only question is whether the tunnel is an unlawful obstruction to the easement, which the city of Chicago may require the railroad company to lower. No freehold is involved in the litigation.

It is next insisted that the case involves franchises. In the first place, it is said that it involves a franchise of the street railroad company to build a tunnel under the river under the charter with the consent of the city through its license. The right of the railroad company to construct the tunnel is not questioned, nor the fact that the tunnel was rightfully constructed in the first instance. The right given by the charter is a limited right to construct a tunnel in such a way that it will not be an interruption of navigation, and that right is not in controversy. The authority given by the State is only a right to construct a tunnel upon the condition provided in the act. There is no attempt to oust the defendant from the exercise of any franchise, and whatever may be the result of this suit the franchise of the corporation will not be lost. If the railroad company should be compelled to lower its tunnel merely because it is an obstruction to navigation, its right to build tunnels in the city of Chicago, as authorized by its charter, would not be taken away or its exercise in a lawful manner prohibited. The question involved in Chicago and Western Indiana Railroad Co. *v.* Dunbar, 95 Ill., 571, is not of the same nature as the question in this case. In the second place, it is urged that a franchise of the city is involved. The city is attempting to compel the lowering of the tunnel on the ground that it is not such a tunnel as the statute authorizes the company to maintain. There is no attempt to oust the city of any franchise, and the franchise of the city is not involved in every attempt to enforce an ordinance. No judgment could be given in this case whereby the city would be deprived of a franchise. Neither the question whether the tunnel is an obstruction to the public easement nor the question whether the ordinance is a reasonable or lawful exercise of the powers conferred by its charter over water courses or tunnels within its limits involves a franchise of the city. All that is required to decide the questions involved is a construction and application of the law to the facts of the case.

Finally, it is claimed that a constitutional question is involved, on the ground that the city is attempting to take the property of the street railroad company without just compensation and without due process of law. We are of the opinion that the issues in the case do not involve any constitutional question. The street railroad company acquired its rights and built its tunnel upon the condition that navigation should not be interrupted. If the tunnel is one which it has a right to maintain in its present location, the city can not require it to be lowered. If it has no right to maintain it in that location because it is an obstruction to navigation and exists in violation of the condition upon which the railroad company was authorized to construct it, its property will not be taken by requiring it to be lowered. It would scarcely be asserted that the public authorities could not remove an obstruction from the bottom of the river without first instituting a condemnation suit to ascertain the damage to the owner of the soil under the river. To maintain the navigable character of the stream in a lawful way is not taking any property or property right of the owner of the soil under the river, which is subject to the right of free and unobstructed navigation.

The appellate court erred in dismissing the writ of error. The judgment of the appellate court is reversed, and the cause is remanded to that court with directions to consider and decide the case upon the errors assigned.

Reversed and remanded.

Mr. Tolman, in handing in the communication, exhibits, and plats, explained the symbols on the plats, in order that the cable lines might be distinguished from the electric lines: he stated in this connection that the plats here presented were prepared for litigation which they had had, and contained one or two lines which were not necessary for the purposes of this case.

Mr. TOLMAN. Mr. Foreman, the chairman of the council committee on local transportation is here this morning, and I think perhaps the chairman would be glad to hear from him.

Mr. FOREMAN. There is but little to add to what the corporation counsel has given you, except to tell what has been done since the supreme court found

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$4,500,000 for us. Immediately after that decision we considered the various engineers in Chicago, and employed Mr. George W. Jackson to present various plans, offering the city of Chicago alternative plans for replacing these tunnels. We are of the opinion that the tunnels are necessary, not only for the carrying of passengers, but for the purposes of navigation. The city of Chicago is anxious to clear the river of obstructions, but it does not want to multiply the bridges any more than is necessary. We have a method by which these tunnels may be built as a part of the subway plan which shall eventually take care of the street railway traffic downtown. One of the plans will be to use these tunnels in connection with a subway system to be built in the downtown district almost simultaneously with the lowering of these tunnels. Now, Mr. Jackson assures me that these plans can be presented in about ninety days to the committee on transportation. The committee will then consider them, and the city council will adopt one of these plans. Hitherto we have passed the appropriation bill about March. It is our intention to pass the appropriation bill next year not later than the first week in January, so that the work on these tunnels may be entered into at once.

I am perfectly willing, so far as representing the committee, to say that the work can be begun immediately after the passage of this appropriation bill. The city of Chicago wants to lower the tunnels, and we want to begin the work immediately after the 1st of January. There are legal obstacles preventing us from beginning sooner. We should have a right to determine how we want those tunnels built, because we have got to take care of the people, and between now and three months from now we will have determined upon a plan, subject to the approval of yourself and the Secretary of War, as to the rebuilding of these tunnels. And I believe the plan which we will present to you will be satisfactory to you and to the Department, and to the navigation interests as well.

I think no plan can be suggested by which these tunnels can be rebuilt as promptly as the one I have just mentioned.

Hon. JAMES R. MANN. These plans that you speak of that Mr. Jackson is preparing—are they for merely the lowering of the tunnels, or are they also for the general subway scheme downtown?

Mr. FOREMAN. They will be drawn with reference to a possible and probable subway scheme to follow; they will be part—they will be the river end of a probable subway scheme.

Hon. JAMES R. MANN. I would like to ask whether, under that sort of a plan, it would be necessary to wait for the lowering of the tunnels until the adoption of a subway scheme downtown?

Mr. FOREMAN. No; by no means. We simply want those tunnels so that at any time in the future that a subway may be built we can use the tunnels.

Hon. JAMES R. MANN. Would that necessarily require the lowering of the tunnels much below the depth required for navigation?

Mr. FOREMAN. Mr. Jackson's plans do not contemplate an extension of the approaches; he has some plans which will not require that.

Colonel ERNST. How long will it be before he is prepared to present these plans?

Mr. FOREMAN. Not more than ninety days; the maximum time that he set was ninety days.

Colonel ERNST. Well, what grade is he working on? He must have some data to start with. For instance, I have not intimated to him how far down the tunnels must go, and he can not make any plans for the tunnels until he knows what levels to make them.

Mr. FOREMAN. He has been working on two levels—one at 26 feet, and then again at about 31 feet, considering alternative plans at these two depths.

Mr. H. D. FORD (chairman transportation committee). You state that you desire to postpone the lowering of these tunnels until this subway idea of Engineer Jackson is about perfected, and then lower the tunnels to meet his proposed subway plans?

Mr. FOREMAN. No; I did not intend to be so understood. I intended to say that we want to be ready to undertake the lowering of the tunnels by the 1st day of next January, but that the particular plan that should be adopted, subject to the approval of the Engineer Department, should be left to the city of Chicago. The city of Chicago should have a voice in just what plan should be adopted.

Mr. FORD. Which will be about the 1st of January, 1905?

Mr. FOREMAN. New plans would be submitted within ninety days.

Mr. FORD. So that you can go to work about the 1st of January. Then you will take care of those people in some manner that now travel?

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Mr. FOREMAN. Undoubtedly.

Mr. FORD. Well, now, why can't they be taken care of in the same manner, and the ends of the tunnels be blocked up, and let the lowering of the tunnels wait, even if it is until 1906?

Colonel ERNST. That question answers itself; I do not think he need answer that.

Mr. MANN. May I ask another question? [Permission given.] Of course you can have the money, so far as the money is concerned, whenever you issue the bonds. It is now a lack of the appropriation under the law. Would not it be possible to submit that to a vote at the November election, so that if the plans were adopted this work could be prosecuted during the winter season, when navigation is closed?

Mr. FOREMAN. Would we gain very much thereby?

Mr. MANN. You will gain one season, probably. You speak of passing the appropriation ordinance in January—of course you are in the city council, and I have been, and I am quite well satisfied that you will never pass an appropriation ordinance until March. Even then the winter is half gone.

Mr. FOREMAN. It would require a sufficient number of votes to adopt it, and if a sufficient number of votes were not cast for it we would be put back a great deal further, while we have an absolute assurance that if we put ourselves to it we can pass that appropriation bill very early in the year.

Mr. MANN. There would be no extra expense about submitting it to a vote in November, I suppose?

Mr. FOREMAN. I had not thought of it.

Mr. FOREMAN. May I be excused, Colonel?

Colonel ERNST. Yes, sir; I am much obliged to you.

I have a letter here from the navigation interests, signed by Messrs. Henry R. Ford, D. Sullivan, Francis Beidler, Geo. Merryweather, R. J. Dunham, committee of the Chicago River Improvement Association, which I will read.

The letter is as follows:

CHICAGO RIVER IMPROVEMENT ASSOCIATION,
Chicago, Ill., May 16, 1904.

Col. O. H. ERNST,
Corps of Engineers, U. S. A.

DEAR SIR: In response to your letter of the 4th instant, asking for expressions of opinion as to what changes should be made in order to remove the obstructive character of the tunnels under the Chicago River, and as to the time within which such changes should be completed, the Chicago River Improvement Association, through the undersigned committee, appointed for this purpose, begs leave to submit that it believes the Hon. L. E. McGann, city comptroller, struck the keynote of this question when, as acting mayor of this city at the time of the passage of the Mann bill by the United States Senate, he was reported by the Chicago newspapers as saying in response to the question as to what methods he thought the city should pursue in handling this question, he replied: "Knock off the tops of the tunnels at once, bulkhead the approaches, in order to preserve them for future use in connection with a subway system, if desired, and allow the traction companies to bring their cars into the center of the city temporarily over the bridges." We believe that Mr. McGann's long experience as commissioner of public works of this city makes him admirably qualified to speak on this question, and we heartily indorse his view of the subject and his method of treating it.

Voicing, as we do, the unanimous opinion of all property owners along the river, and all the business interests situated thereon, as well as all the vessel-owning interests navigating the river, we can not urge too strongly prompt action under the act of Congress in question for the same reasons which prompted its passage, all of which have been recently discussed publicly and by the press to such an extent as to need no reiteration here. It is not our desire to appear selfish in urging the utmost haste in this matter, knowing, as we do, that there are other important interests and questions to be considered, but we believe the interests of the greatest number of people can best be served by adopting the following policy:

As the tunnels at La Salle and Van Buren streets have never been as obstructive in character as that at Washington street, we would recommend to those we represent that they bear with and patiently endure the difficulties encountered at the two former tunnels for a reasonable time, while plans are being duly prepared and discussed to obviate the difficulties there, if the parties in interest will immediately take active steps to alleviate the conditions at Wash-

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ington street. The navigable channel here at Washington street is now not only obstructed by the tunnel limiting the draft of water, but has been made extremely hazardous and dangerous to vessels very recently by the widening of the channel by the sanitary district to a width of 200 feet from dock to dock. All of this additional width has been taken from the land on the west side of the river. The consequence is that the east end of the west approach to Washington street bridge is now about in the middle of the west or deepest channel, this being the channel wholly used by deeply laden boats bound both in and out of the river. The result of this is that in the event of a vessel bound south grounding on the tunnel at this point the current will carry her stern across the river and against the west dock, the width now being sufficient to allow a steamer's rudder and wheel to strike the dock, with the natural result of serious damage. We would respectfully ask you personally, or through a representative, to visit this point and take a view of the channel south from Randolph street bridge in its present condition, and, if you desire, any member or all of this committee will meet you or your representative on the ground and at a time that suits your or their convenience, and will demonstrate to you or them the truth of our statements. We are informed that plans have already been made and approved for a new bascule bridge at this point. If so, work should be commenced within thirty days to tear out this bridge, and thirty days later dredges should be put to work dredging off the top of this tunnel, so that there will be a clear draft of water of at least 19 feet.

If Comptroller McGann's method is followed out, remedying the difficulties at the tunnels one at a time, commencing with Washington street, it is clear to us that the public or the traction companies will not be inconvenienced, and the marine and commercial interests of Chicago and the Great Lakes will be speedily relieved of the burdens that have rested upon them for years.

Respectfully submitted.

HENRY B. FORD,
D. SULLIVAN,
FRANCIS BEIDLER,
GEO. MERRYWEATHER,
R. J. DUNHAM,
Committee.

Colonel ERNST. Mr. R. J. Dunham and Mr. Sullivan, of the Chicago River Improvement Association, are present. If they desire to supplement this statement just read I would be glad to hear from them, or either of them.

Mr. SULLIVAN. I do not think there is anything, unless you add to that further that the suggestion of knocking off the top of the tunnel so there will be a clear draft of water of 19 feet is only temporary; that the river bed is not as deep as that.

Mr. SEEBERGER. I would like to present a communication from the Chicago Real Estate Board.

The letter presented was read by Colonel Ernst, and is as follows:

CHICAGO, *May 18, 1904.*

OSWALD H. ERNST,
General Division Engineer, Northwest Division, U. S. Army.

DEAR SIR: The Chicago Real Estate Board, numbering the largest owners of and dealers in property on the Chicago River, has observed for twelve years a constant decrease in the commerce of the river and in the value of dock property. The decline in the commerce of the Chicago River has not only depressed value of real estate fronting upon the river, but has been of serious effect in a much wider sense—it has injured the entire city.

This condition has been due primarily to the tunnels in the Chicago River.

The excuse for their continued existence has been the financial inability of the city government to lower or otherwise remove them. By a recent decision of the supreme court of Illinois the city has the power to raise a large sum of money by issuing additional bonds, and the financial obstacle has thereby been removed.

The Chicago Real Estate Board, in the belief that it is of the utmost importance and is imperative that these obstructions to commerce be removed with the least possible delay, favors the plan of building bulkheads within the tunnels at or near the shore lines and the removal of the tops of the tunnels.

LOUIS A. SEEBERGER,
ROBERT E. ISMOND,
HENRY H. WALKER,
For the River Improvement Committee of the Chicago Real Estate Board.

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Mr. ISHAM RANDOLPH (chief engineer sanitary district). Mr. Chairman, if it is in order, may I saw a few words?

Colonel ERNST. We would be glad to hear from you, Mr. Randolph.

Mr. RANDOLPH. I appear at this meeting under instructions from the sanitary district of Chicago, to represent the trustees. The invitation sent out by Colonel Ernst was received, and I wish to state that the interest of the district in this matter is almost solely their interest in the navigation of the Chicago River. The conditions at Washington street are as bad as anybody has ever painted them. The district has endeavored for a long time to alleviate those conditions, but are unable to do so. At the present time it is their purpose to build a bridge at this site. The plans for this bridge will depend, in a large measure, upon the width which the city shall determine to make the bridge. It is our belief that the bridge should be the full width of the street; that is also the expressed opinion of the commissioner of public works. The approaches to this bridge are now obstructed by side ways leading down to the river, and it is a question whether those approaches can be closed, and if they can not be closed, whether it is worth while to build the bridge the full width of the street. My own opinion is that the bridge should be built the full width of the street, and let the future take care of the approaches.

In the event of its being decided that it is best to knock off the top of the tunnels, or rather, the Washington street tunnel, I am prepared to express my belief, although there has been no action of the board, that the district will be perfectly willing to bear the expense of putting in the bulkheads to protect the approaches.

Colonel ERNST. I would like to ask Mr. Randolph's views as to the depth that ought to be placed over these tunnels. The cross section adopted by the drainage board in other parts of the river gives an area of about 5,000 or 4,700 square feet; now, that means a depth of 26 feet in the center for a width of 100 feet, and 16 feet at the bulkheads—at the shore line—the surface width being 200 feet. What cross section do you adopt between the piers in the bascule bridges? Do you give the same area there—4,700 square feet?

Mr. RANDOLPH. Approximately the same area. The width between the protections is 140 feet; from the protections back to the face of the masonry is about 8 feet—that is, carried down to the full depth of 26 feet.

Colonel ERNST. So that the width of the 26-foot depth is greater there than elsewhere?

Mr. RANDOLPH. Yes, sir.

Colonel ERNST. And your opinion, I infer, is that the area should be the same over these tunnels?

Mr. RANDOLPH. Yes, sir; I think it should.

Colonel ERNST. Does anyone else wish to be heard on that question—the question of cross section? It is an important question. There is an area of cross section to be provided for, for the discharge of this large volume of water which has to go down through the drainage canal. There is something to be considered besides the draft of vessels, and I am inclined to believe that 26 feet is the proper depth. I would be glad to hear from anyone else.

Mr. MANN. I would like to ask whether it would be practicable, if the city would agree to it, to close the Washington street tunnel? Is there sufficient bridge space now for the street-car lines if the Washington street tunnel be closed immediately or soon? Or would the railroad companies be willing to do that? Mr. Artingstall, I would like to have you answer that; they stated you were ready to answer every question.

Mr. ARTINGSTALL. I do not think that has been taken into consideration by the officers of the railroad companies.

Mr. MANN. It is the most practical question there is.

Mr. ARTINGSTALL. I will state this much—that the traffic through that tunnel will have to be suspended during the reconstruction of the river portion, which will probably be twelve months, at least, before we can reconstruct the river portion.

Mr. MANN. Well, if the city should give its consent, is there any engineering objection to closing the tunnel and bringing the traffic across the bridges?

Mr. ARTINGSTALL. Not that I know of.

Colonel ERNST. Does any other gentleman wish to address the meeting? [No response.] I will consider all these points that have been laid before me, and make my report to the Chief of Engineers in due time.

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Mr. MANN. Mr. Chairman, you spoke of depth. It has been a question in my mind as to whether, if it becomes necessary to put the tunnels lower than would otherwise be required by navigation, because of the flow that the sanitary district wants through the river, whether the sanitary district ought not to contribute toward the expense. I simply make that suggestion to them. If they want the tunnels 4 feet lower than navigation requires, whether they should not pay for it.

Colonel ERNST. Gentlemen, I am much obliged to you for coming here to-day. If no one else wishes to address the meeting, the meeting is now adjourned. [11.30 a. m.]

K K 3.

IMPROVEMENT OF CALUMET HARBOR, ILLINOIS.

The object of the work originally was to provide a deep entrance to the Calumet River and the port of South Chicago. Under the latest project it is also to provide a harbor of refuge and anchorage ground in front of the river mouth, as well as an easy approach to the entrance.

The first object was accomplished by first protecting the proposed channel by parallel piers 300 feet apart, projecting into the lake from the shore, and then dredging between them to the proper depth. Work was begun in 1870, and by the 30th of June, 1876, a channel 16 feet deep between the piers had been secured and the old project completed.

By the act of March 3, 1899, as modified by the act of June 13, 1902, it was still further enlarged so as to provide for a breakwater 6,900 feet long connected with the shore and running due east into the lake 4,400 feet and extended in a southeasterly direction 2,500 feet, the area sheltered by the breakwater to be dredged to 20 feet depth; the south pier at the mouth of Calumet River to be extended 800 feet, and the Calumet River dredged to a width of 200 feet and depth of 20 feet for a distance of 2 miles from the mouth.

At the beginning of the fiscal year all of this work had been completed except the extension of the breakwater 2,500 feet in a southeasterly direction, which was being prosecuted under a contract entered into November 12, 1902, with the firm of Gillen & Gillen, of Racine, Wis., and was about 50 per cent completed. Work under this contract was completed December 17, 1904, except a portion of the ice guard, which was omitted because of the prevailing high stage of the lake level, the following work having been accomplished during the fiscal year: Nine hundred feet of stone foundation completed; 10 cribs, each 30 by 100 feet, 24 courses high, sunk in place and filled with stone; 2,000 feet of superstructure, including decking, completed; and three clumps of piles placed at outer end of the breakwater.

The payments to the contractors for the extension of the breakwater aggregate $276,030.87.

A contract was entered into November 18, 1904, with the Chicago and Great Lakes Dredge and Dock Company for rebuilding the superstructure over the westerly or inner 1,200 feet of the south pier, and for decking the whole length of it with 4-inch pine. Work was

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begun April 17, 1905, and at the close of the year was about 50 per cent completed, the old work having been removed, 850 feet of new superstructure built, and 150 feet of decking laid.

It will be necessary to repair the superstructure over 300 additional feet of the pier adjoining the 1,200 feet contracted for, and this should be done at once.

The breakwaters and piers, except the inner end of the south pier, referred to above, are in good condition.

The self-registering gauge was maintained throughout the year, and a table of daily and monthly means was constructed for each month. The original rolls and a copy of the tables have been sent to the lake survey office for preservation and for use in the study of the general hydraulics of the Great Lakes. Sudden extreme fluctuations were observed twice. April 10, 1905, the level of the lake fell 3.15 feet in twenty-one minutes, between 7.14 and 7.35 a. m., and May 12 rose 3.26 feet in thirty-two minutes, between 12.07 and 12.39 a. m.

For detailed information, see report of Assistant Engineer G. A. M. Liljencrantz herewith.

It is proposed to apply the funds now available to the necessary repair and maintenance of the works.

Money statement.

July 1, 1904, balance unexpended		$301,668.68
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$184,756.13	
For maintenance of improvement	959.70	
		185,715.83
July 1, 1905, balance unexpended		115,952.85
July 1, 1905, amount covered by uncompleted contracts		16,025.11

APPROPRIATIONS.

By act of—		By act of—	
July 11, 1870	$50,000.00	March 3, 1899	$150,000.00
March 3, 1871	50,000.00	June 6, 1900	185,350.00
June 10, 1872	40,000.00	March 3, 1901	255,000.00
March 3, 1873	40,000.00	Sundry civil act of June 28, 1902	215,000.00
June 23, 1874	25,000.00	Sundry civil act of March 3, 1903	204,480.00
March 3, 1875	25,000.00		
August 3, 1876	20,000.00	Total	1,547,230.00
June 18, 1878	15,000.00	Amount received from sale of property	1.00
March 3, 1879	12,000.00		
June 14, 1880	20,000.00	Total	1,547,231.00
March 3, 1881	30,000.00	Expended to June 30, 1905	1,431,278.15
August 2, 1882	35,000.00		
July 5, 1884	20,000.00	Balance unexpended June 30, 1905	115,952.85
August 5, 1886	10,000.00		
August 11, 1888	20,400.00		
September 19, 1890	20,000.00		
July 13, 1892	15,000.00		
August 18, 1894	15,000.00		
June 3, 1896	75,000.00		

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ABSTRACT OF CONTRACTS IN FORCE DURING FISCAL YEAR ENDING JUNE 30, 1905.

Name of contractor.	Character of the work.	Price per unit.	Date of approval.	Date of beginning of work.	Date of expiration.
Gillen & Gillen, Racine, Wis.	Breakwater construction.	Hemlock timber ..... $25.70 Oregon fir timber ..... 32.00 Pine decking .. 26.00 White-oak piles ..... 12.00 Oak plank ..... 35.00 Spikes, per pound ..... .04½ Screw bolts, per pound ... .04½ Dredge chain, per pound ... .10 Steel plate, per pound ..... .10 Stone, per cord 5.75	Dec. 4, 1902 (E. D. File No. 44554).	10 days after notification of approval of the contract.	Dec. 31, 1903. Extended for a reasonable period. Completed Dec. 17, 1904.
Chicago and Great Lakes Dredge and Dock Co., Chicago, Ill.	Rebuilding the superstructure and laying new decking.	Timber, in place ..... 34.00 Decking, in place ..... 26.00 Driftbolts, in place, per pound ..... .04 Spikes, in place, per pound ..... .08½ Stone, per cord 5.50	Dec. 3, 1904 (E. D. File No. 52751).	On or before Apr. 1, 1905.	On or before July 1, 1905. Extended to Sept. 1, 1905.

COMMERCIAL STATISTICS.

Amount of revenue collected at nearest port of entry (Chicago) during fiscal year 1905, $7,964,313.73.

Arrivals and clearances of vessels, Calumet Harbor, Illinois.

Vessels.	Arrivals.		Clearances.	
	Number.	Tons.	Number.	Tons.
Steam	759	1,846,171	895	2,085,318
Sail	266	576,283	267	575,795
Total	1,025	2,422,454	1,162	2,661,113

Receipts and shipments by lake at South Chicago, Ill., during calendar year 1904.

Receipts.	Quantity.	Shipments.	Quantity.
	Tons.		*Tons.*
Coal	262,182	Wheat	61,346
Iron ore	2,558,440	Corn	482,327
Salt	18,145	Oats	40,846
Lumber	49,624	Rye	3,136
Shingles	2,507	Barley	19,176
Lath	200	Flour	20,007
Posts	1,065	Mill stuffs	4,472
Ties	6,374	Oil cake	2,369
Poles	89,060	Grass seed	19
Wood	2,965	Oil	30,547
Plaster	8,500	Pork	17
Groceries	360	Tallow	45
Grain	31,020	Wool and hair	313
Unclassified	1,360	Groceries	1,360
		Iron	18,649
		Unclassified	61,409
Total	2,982,822	Total	745,988

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Comparison of receipts and shipments by lake at South Chicago, Ill., for calendar years 1895 to 1904, inclusive.

Year.	Tons.	Year.	Tons.
1895	2,857,750	1900	3,783,674
1896	2,973,724	1901	3,995,277
1897	3,498,218	1902	4,454,428
1898	4,117,526	1903	4,742,225
1899	3,229,874	1904	3,728,280

REPORT OF MR. G. A. M. LILJENCRANTZ, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Chicago, Ill., July 7, 1905.

COLONEL: I have the honor to submit the following report on operations in Calumet Harbor, Illinois, during the year ending June 30, 1905:

There was one contract in force at the beginning of the year for the improvement of this harbor, viz, with Messrs. Gillen & Gillen, of Racine, Wis., dated November 12, 1902, for the extension of the breakwater a distance of 2,500 feet.

WORK DONE DURING THE YEAR.

Work under the contract was continued until the 17th of December, 1904, when it was completed and the contract closed. At the beginning of the year the stone foundation was practically completed for a distance of 1,600 feet; 15 cribs, 30 feet wide, 24 courses (24½ feet) high and 100 feet long each, had been sunk in place and filled with stone. The superstructure, including decking and stone filling, was completed for a distance of 500 feet.

After the first fifteen cribs had been sunk in successive order in the work, the sixteenth crib was sunk on the site for crib No. 25—i. e., at the outer end of the proposed breakwater—and clumps of piles were placed around the outer end of this crib for protection. The gap between was afterwards filled by the sinking of the remaining nine cribs, alternately from the inner and outer ends.

A portion of the ice guard had to be omitted, owing to the prevailing high stage of the lake level. The last payment was made on the 23d of December, 1904, the total payments under the contract amounting to $276,030.87, or at the rate of $110.41 per linear foot of the work, on an average. The work is in good alignment, but has settled to some extent in a few places.

With the closing of the contract the duty of the contractors to keep lights at the end of the new work ceased, and the United States Light-House Department not being ready to perform this important duty, such lights have been kept up during the winter and until the present time, under authority from the Department of December 13, 1904, a man being employed for that purpose at the rate of $50 per month.

The superstructure over the inner or westerly portion of the south pier had deteriorated for some time to a considerable extent, and under authority from the Department under date of September 20, 1904, and after due advertising for proposals, which were opened on November 4, 1904 a contract was entered into on the 18th of November following with the lowest responsible bidders, the Chicago and Great Lakes Dredge and Dock Company, for the rebuilding of the superstructure over the westerly 1,200 feet of this pier and for covering the whole length of it with 4-inch thick pine decking.

Work under this contract was begun on the 17th of April of the present year. Under the terms of the contract this should have expired at the close of the fiscal year, but at the request of the contractors in letter of June 8, 1905, and owing to the prevailing high stage of the lake level, which made a satisfactory connection between the cribs and the superstructure very difficult to accomplish, an extension of time was granted—in letter of June 15 following—for "a reasonable time."

At the close of the year the old work had been removed for a distance of about 1,200 feet; 850 feet of new superstructure had been built, of which 150 feet were covered with decking.

During the progress of the work it was discovered that about 300 linear feet of the superstructure adjoining to the eastward the portion contracted for to be renewed was in a worse condition than had at first appeared, to the extent that

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it will not hold the spikes for the new decking contemplated at this place. These 300 feet should also be renewed, which however can not be done under the terms of the existing contract.

WORK PROPOSED FOR THE YEAR ENDING JUNE 30, 1906.

It is proposed to continue with the work under the existing contract and to complete the same in the early part of the ensuing year.

* * * * * * *

Quite a number of large vessels have grounded during the year on the "Calumet bar," or "Rockefeller shoal," and soundings have been taken annually over it and are expected to be taken this fall for the purpose of studying the effect of the new breakwaters on its extent, horizontally as well as vertically, before any propositions are made for the removal of the same. The United States Light-House Department has kept it marked with a gas buoy during the seasons of navigation.

The yacht *Torteth* was sunk in the main channel about opposite the United States life-saving station on the 18th of November, 1904. It was abandoned by its owners and was finally, on the 24th of March, 1905, removed by this office under contract with the Chicago and Great Lakes Dredge and Dock Company after written proposals had been received, accepted, and approved, at a cost of $200.

Dredging was done in the area sheltered by the breakwaters by and at the expense of the Illinois Steel Company, during the month of June last, for the purpose of forming a 23-foot deep channel, 200 feet wide, leading to their private north harbor; also between the United States harbor piers, to a depth of 21 feet, where shoaling had taken place, to enable their deep-draft ore-laden steamers to reach their slip, which connects with the main channel.

The plant of this company has been remodeled in part during the year, and has been materially enlarged by way of new blast furnaces and mills for enlarged and more varied production of steel and iron.

I am, Colonel, very respectfully, your obedient servant,

G. A. M. LILJENCRANTZ,
Assistant Engineer.

Lieut. Col. W. H. BIXBY,
Corps of Engineers.

K K 4.

IMPROVEMENT OF CALUMET RIVER, ILLINOIS AND INDIANA.

Under the contract with the Griffith, McDermott & Watt Dredging Company, of Chicago, approved March 20, 1903, 370,251 cubic yards of material were dredged during the year, and the contract was closed April 15, 1905. There were dredged in all under this contract 444,523 cubic yards of material measured in place, for which the contractors were paid 14½ cents per cubic yard, less $1,363.80 inspection charges during the time for which the contract was extended, a net amount of $63,092.04.

Under a contract with the Fitz Simons & Connell Company, of Chicago, approved August 23, 1904, for restoring the 21-foot channel between One hundred and sixth street and the mouth of the river, for which work an allotment of $43,000 from the emergency river and harbor act of April 28, 1904, was made, 175,651 cubic yards of material were dredged, for which the contractors were paid 22½ cents per cubic yard measured in place, less $342 inspection charges during the time of extension of the contract, or $39,179.48.

As all the work needed to restore the 21-foot channel had not been completed by this contract, a shallow section between Ninety-second Street Bridge and the mouth of the river being left undredged, and as there was also a shallow section between One hundred and tenth and

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One hundred and eleventh streets, a contract was entered into June 15, 1905, with the Great Lakes Dredge and Dock Company, of Chicago, for dredging both these places, and at the close of the year such work was in progress and nearly completed at the first-mentioned place.

The present project for the improvement of this river, adopted by Congress in the river and harbor act approved March 3, 1905, "in accordance with the report submitted in House Document No. 172, Fifty-eighth Congress, second session," is:

To provide a channel 200 feet wide and 20 feet deep from the mouth of the river to One hundred and twenty-second street, and of the same width and 16 feet deep from One hundred and twenty-second street to the forks, with five turning basins, at a total estimated cost of $662,480.50, and $10,000 per annum for maintenance; and to acquire, as prescribed in the act of June 13, 1902, the land required for a channel 200 feet in width from the forks to a point one-half mile above Hammond, Ind. (i. e., by deeds free of charge to the United States), and as specially provided by the act of March 3, 1905, to acquire in similar way the lands necessary for the five turning basins below the forks.

Congress, by the act approved March 3, 1905, appropriated $100,000 in accordance with this project and provided that a contract or contracts may be entered into for such materials and work as may be necessary for the prosecution of said project, not to exceed in the aggregate $176,000 additional.

After advertising, a contract was made June 1 and approved June 30, 1905, with the lowest bidder, the Great Lakes Dredge and Dock Company, of Chicago, for removing the "rock section" between One hundred and eleventh and One hundred and fourteenth streets, but no removal has yet been actually effected.

No deeds have yet been offered or received for lands needed for either the turning basins below the forks or for a river channel above the forks.

The wreck of the small yacht *Toxteth* was removed from the channel of the river near its mouth, at a cost of $200, under work of the Calumet Harbor improvement.

For detailed information, see report of Asst. Engineer G. A. M. Liljencrantz, attached.

It is proposed to apply the funds now available and those asked for for the year ending June 30, 1907, to continuing the enlargement of the channel progressively from downstream upward.

Money statement.

July 1, 1904, balance unexpended		$102,250.64
Amount appropriated by river and harbor act approved March 3, 1905		100,000.00
Unexpended balance of allotment for rivers and harbors, Board of Engineers, returned		83.16
		202,333.80
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$48,365.04	
For maintenance of improvement	41,718.98	
Redeposited to credit of Treasurer of United States, balance of allotment of $43,000 from act of April 28, 1904	1,281.02	
		91,365.04
July 1, 1905, balance unexpended		[a]110,968.76

[a] Including $5,950.75 for "Above the Forks."

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July 1, 1905, amount covered by uncompleted contracts (including $48,487.50 under continuing contract)	$143,487.50
Amount (estimated) required for completion of existing project	497,480.50
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:	
For works of improvement	$200,000.00
For maintenance of improvement	10,000.00
	210,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

APPROPRIATIONS.

By act of—	
July 5, 1884	$50,000.00
August 5, 1886	30,000.00
August 11, 1886	50,000.00
September 19, 1890	50,000.00
July 13, 1892	75,000.00
August 18, 1894	45,000.00
June 3, 1896	50,000.00
March 3, 1899	60,000.00
June 13, 1902	75,000.00
April 28, 1904 (allotment)	43,000.00
March 3, 1905	100,000.00
Total	628,000.00

Amount expended to June 30, 1905	$515,750.22
Redeposited to credit of Treasurer of United States, balance of allotment of $43,000 from act of April 28, 1904	1,281.02
Total	517,031.24
Balance unexpended June 30, 1905 (including $5,950.75 for "Above the Forks")	110,968.76

ABSTRACT OF CONTRACTS IN FORCE DURING FISCAL YEAR ENDING JUNE 30, 1905.

Name of contractor.	Character of the work.	Price per unit.	Date of approval.	Date of beginning of work.	Date of expiration.
Griffiths, McDermott & Watt Dredging Co., Chicago, Ill.	Dredging	14½ cents per cubic yard, measured in place.	Mar. 20, 1903 (E. D. File No. 46027).	Opening of navigation, 1903.	9 months after commencement. Extended reasonable time. Completed Apr. 14, 1905.
The Fitz Simons & Connell Co., Chicago, Ill.	do	22½ cents per cubic yard, measured in place.	Aug. 23, 1904 (E. D. File No. 51703).	10 days after notification of approval of contract.	Dec. 31, 1904. Extended reasonable time. Completed June 1, 1905.
Great Lakes Dredge and Dock Co., Chicago, Ill.	Rock excavation and dredging.	$2.25 per cubic yard for rock, measured in place, and 20 cents per cubic yard for soft material, measured in scows.	June 30, 1905 (E. D. File No. 54634).	On or before July 1, 1905.	June 30, 1907.
Do	Dredging (in two different places).	22 cents per cubic yard, measured in place; 12½ cents per cubic yard, measured in scows.	Emergency contract (E. D. File No. 55895).	On or before June 25, 1905.	60 days after commencement.

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REPORT OF MR. G. A. M. LILJENCRANTZ, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Chicago, Ill., July 7, 1905.

COLONEL: I have the honor to submit the following report on operations in Calumet River, Illinois and Indiana, during the year ending June 30, 1905.

There was one contract in force at the beginning of the year for the improvement of this river, viz, with the Griffiths, McDermott & Watt Dredging Company, of Chicago, Ill., dated February 20, 1903, for deepening the channel from One hundred and sixth to One hundred and tenth street, to a depth of 20 feet below city datum and the width of 200 feet between established channel lines, and to a depth of 14 feet from One hundred and eighteenth street southwardly as far as available funds would permit.

WORK DONE DURING THE YEAR.

At the beginning of the year there remained to be removed under the terms of the contract about 287,700 cubic yards, the amount of 174,272 cubic yards having been removed during the previous year, of which 94,980 cubic yards were taken from the channel between One hundred and sixth and One hundred and tenth streets.

Work under the contract was continued until the 13th of April, 1905, when operations ceased and the contract was closed. The last work was done to a point about 900 feet above (southwest of) the Chittenden bridge. About 50 feet on each side of this bridge was left undredged—except a narrow channel through the draw—so as not to endanger that structure, and the channel above the bridge, where a cut-off was made through the so-called "Oxbow bend," was deepened to between 8 and 10 feet, this limit being fixed to insure against an excess in cost beyond the amount available for this work and in view of the fact that a less depth is found beyond this place.

The final payment was made on April 14, 1905. The total amount removed under the contract was 444,523 cubic yards, the cost of which, at the rate of 14½ cents per cubic yard, was $64,455.84, less the inspection charges during time-extension, amounting to $1,363.80, deducted from the amount due the contractors who were thus paid the sum of $63,092.04.

From the emergency river and harbor act approved April 28, 1904, an allotment of $43,000 was granted for the purpose of restoring the 21-foot channel between One hundred and sixth street and the mouth of the river. Proposals were invited for this work and opened on the 26th of July, 1904. The Fitz Simons & Connell Company, of Chicago, Ill., were the lowest bidders, at 22½ cents per cubic yard, measured in place. A contract was entered into with that firm on August 10 following, and this was approved by the Chief of Engineers on the 23d of that month. Work under this contract was begun, at One hundred and sixth Street Bridge, on the 22d of the same month, with the understanding that the work done prior to the approval of the contract would be at the risk of the contractors. The work was continued until the 16th of December, when operations were closed for the season. The work was resumed on the 30th of March, 1905, and carried on until the 31st of May, when the channel had reached the east side of the Ninety-second Street Bridge.

As has been stated before, the payments were made for "measurements in place," and it was expected that the work to the point mentioned above would exhaust the available funds, but when quantities were computed there was found to be a balance of $1,281.02, which was deposited in the subtreasury, and the contract was closed. The final payment was made on June 3, 1905. There were removed in all under the contract 175,651 cubic yards which, at the rate of 22½ cents per cubic yard, amounted to $39,521.48. The inspection charges (for the months of April and May), amounting to $342, were deducted from the above amount and the contractors were thus paid the remainder, or, $39,179.48.

By the river and harbor act approved March 3, 1905, an appropriation was made as follows:

"Improving Calumet River, Illinois and Indiana: For improving said river in accordance with the report submitted in House Document Numbered One hundred and seventy-two, Fifty-eighth Congress, second session, and for maintenance, one hundred thousand dollars: *Provided*, That a contract or contracts may be entered into by the Secretary of War for such materials and work as may be necessary for the prosecution of said project, to be paid for as appropriations may from time to time be made by law, not to exceed in the aggregate

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one hundred and seventy-six thousand dollars, exclusive of the amounts herein and heretofore appropriated." * * *

Specifications for the removal of the "rock-section" between One hundred and eleventh and One hundred and fourteenth streets were accordingly prepared, and were approved by the Chief of Engineers on the 6th of April, 1905. Proposals for the work were opened on May 15. The Great Lakes Dredge and Dock Company were the lowest bidders, at $2.25 per cubic yard, measured in place. The bid was approved on May 23 and a contract entered into with the said firm on June 1, and this was approved on the 30th of that month. No work has as yet been done under this contract.

As above stated, the work under contract with the Fitz Simons & Connell Company was not completed further than to the east side of the Ninety-second Street Bridge, thus leaving a shallow section between this bridge and the mouth of the river, an obstruction to vessels desiring to reach the 21-foot channel above. Between One hundred and tenth and One hundred and eleventh streets is also a shallow section of the river. At the latter street a slip is being constructed jointly by the Semet-Solvay Company and the Albert Dickinson Company, which firms are also building extensive plants on each side of this slip and along the river front. These firms are very anxious to get deep-draft vessels up to their slip as soon as it is finished.

On account of these circumstances, and in view of the fact that there was a small available balance from the old appropriation, circular invitations for proposals for dredging at each of the two places named were issued. Bids were opened on the 3d of June last. An emergency contract was entered into with the lowest bidders for both places—the Great Lakes Dredge and Dock Company, on June 15, at the following prices: For dredging near Ninety-second street, 22 cents per cubic yard, measured in place; at One hundred and tenth street, 12¾ cents per cubic yard, measured in scows. Work under this contract commenced at Ninety-second street on June 26, and at the close of the year this work was nearly completed, but has not yet been measured.

WORK PROPOSED FOR THE YEAR ENDING JUNE 30, 1906.

It is proposed to complete in the early part of the year the work contracted for at Ninety-second and One hundred and tenth streets, and to proceed with operations in the "rock section" as far as available funds will permit, beginning with making a channel along the deeper westerly side of the river and widening this channel as far as now available funds will permit; next, to complete it to the full width of 200 feet as soon as an additional appropriation has been made and becomes available.

An act of Congress (Public, No. 132) "In relation to the location of the navigable channel of the Calumet River, Illinois and Indiana," was approved April 21, 1904, and was as follows:

"*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled*, That the portion of the old channel of the Calumet River in the northwest quarter of section thirty, township thirty-seven north, range fifteen east, of the third principal meridian, in Cook County, Illinois, which lies ouside of the new channel lines as established by the United States and shown on 'Map of the Calumet River, Illinois, from Lake Michigan to Calumet Lake, to accompany report of W. G. Ewing, United States attorney to the Attorney-General, respecting cession of right of way for improvement of said river under act of Congress approved July fifth, eighteen hundred and eighty-four,' is hereby abandoned as navigable water from and after the time that a navigable channel shall be cut through said quarter section within the new channel lines of the river as shown on said map."

Regulations for the operation of all drawbridges across the Calumet River and it branches were established by the Secretary of War on the 6th of December, 1904. Copies of these were printed and are kept on hand in this office for distribution. Some copies were also framed and exhibited in public places, and the regulations were furthermore embodied in "Bulletin No. 15, Survey of Northern and Northwestern Lakes" (pp. 98 and 99).

The so-called Chittenden Bridge near One hundred and twenty-third street is soon to be removed, the city of Chicago having obtained authority from the Secretary of War on October 21, 1904, to build a temporary ponton bridge at Torrence avenue, and as soon as this bridge and the road leading to it are completed the former bridge will be removed, when the channel at this place can be dredged to its full width.

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The industrial activity along the river during the past year has been quite noteworthy. Millions of dollars have been expended in completing enterprises previously inaugurated. Among these the most prominent are the steel plant of the International Harvester Company at One hundred and sixth street and the Grand Crossing Tack Company at One hundred and eighteenth street; also large additions made to the General Chemical Company at One hundred and twenty-second street.

A slip, 1,200 feet long, 175 feet wide, and 21 feet deep, is being built near One hundred and eleventh street, jointly by the Semet-Solvay Company and the Albert Dickinson Company, and it is claimed that from four to five millions of dollars will be expended on the plants now in process of erection in this locality by the two firms.

It has been positively affirmed that steps have been taken for securing a large tract on the river for a steel mill plant of extensive character, and another similar tract for blast furnaces for making pig iron.

The American Ship Building Company, located at One hundredth street and the river, has lately launched two steel steamers, each 569 feet long, 58 feet beam, and having 10,000 tons capacity. These are claimed to be the largest yet built on the Great Lakes.

I am, Colonel, very respectfully, your obedient servant,

G. A. M. LILJENCRANTZ,
Assistant Engineer.

Lieut. Col. W. H. BIXBY,
Corps of Engineers.

K K 5.

SURVEY OF ILLINOIS AND DES PLAINES RIVERS, ILLINOIS. FOR WATERWAY FROM LOCKPORT, ILLINOIS, TO ST. LOUIS, MISSOURI.

The survey, maps, plans, and estimates for a 14-foot waterway from Lockport, Ill., to the mouth of the Illinois River, conducted under the Board of Engineer officers appointed by Special Orders, No. 19, Headquarters Corps of Engineers, July 5, 1902, were completed except some minor work on the small-scale map and the preparation of final reports.

The final meeting of the Board will be held as soon as permitted by other duties of its members, and the final report will be submitted within a few months.

Lieut. Col. Chas. J. Allen was retired from active service January 8, 1904, and was replaced on the Board by Maj. Jas. L. Lusk, Corps of Engineers, by virtue of Special Orders, No. 17, dated War Department, Office of the Chief of Engineers, April 26, 1904, and by Special Orders, No. 15, War Department, Office Chief of Engineers, April 6, 1905, Major Lusk was replaced by Lieut. Col. W. H. Bixby.

For details of the work see report of J. W. Woermann, assistant engineer, hereto appended:

Money statement.

July 1, 1904, balance unexpended	$43,164.17
Received from sales	10.00
	43,174.17
June 30, 1905, amount expended during fiscal year, for works of improvement	39,507.11
July 1, 1905, balance unexpended	3,667.06
July 1, 1905, outstanding liabilities	175.00
July 1, 1905, balance available	3,492.06

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REPORT OF MR. J. W. WOERMANN, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Chicago, Ill., July 12, 1905.

COLONEL: I have the honor to submit the following report of the work accomplished under my direction during the fiscal year ending June 30, 1905, in connection with the surveys, maps, plans, and estimates for a 14-foot waterway from Lockport, Ill., to the mouth of the Illinois River via the Des Plaines and Illinois rivers, and for 7 and 8 foot channels from Lasalle to Ottawa, Ill.

The character and scope of the survey, the methods used in the field, the instructions issued for the conduct of the various branches of the work, the descriptions of targets and permanent monuments, etc., were given in my previous reports and will not be repeated here.

As far as possible a record has been kept, in tabular form, since the beginning of the survey, of the various items entering into the field and office work. The following table shows the principal items for each fiscal year, and also the total for the complete survey and two sets of finished maps:

Items.	Year ending June 30—			Total to June 30, 1905.
	1903.	1904.	1905.	
Secondary triangulation.				
Number of stations established	64	78		137
Number of stations occupied	61	83		144
Number of angles observed	226	266		492
Permanent monuments set	53	67		120
Prominent buildings located	25	149		174
Number of towers erected	14	44		58
Number of triangles adjusted and computed	63	106	6	175
Number of stations, coordinates computed	61	61		122
Number of stations, latitude and longitude computed		106	96	202
Number of buildings, latitude and longitude computed			43	43
Number of stations, seconds in feet computed		66	136	202
Number of buildings, seconds in feet computed			43	43
Tertiary triangulation.				
Number of stations established	249	820		1,069
Number of stations occupied	251	833	31	1,115
Number of angles observed	729	2,452	91	3,272
Permanent monuments set			18	18
Prominent buildings located			34	34
Number of base lines measured	16	12		28
Number of triangles adjusted and computed	253	783	21	1,057
Number of stations, coordinates computed	243	830		1,073
Number of stations, latitude and longitude computed			29	29
Number of buildings, latitude and longitude computed			23	23
Number of stations, seconds in feet computed			29	29
Number of buildings, seconds in feet computed			23	23
Precise levels.				
Miles of duplicate levels	137.9	205.5		343.4
Miles of single line, rerunning, etc	52.3	57.2		109.5
Total miles of single line	328.1	468.2		796.3
Permanent bench marks established	44	95		139
Temporary bench marks established	206	282		488
Other bench marks determined		82		82
Corrected elevations computed, permanent bench marks			163	163
Corrected elevations computed, temporary bench marks			563	563
Level books checked completely			55	55
Topography.				
Number of stations occupied	6,905	10,814		17,719
Square miles of topography taken	290.1	392.6		682.7
Section corners located	208	160		368
High-water marks determined	103	56	52	211
Hydrography.				
Number of stations occupied	1,373	4,588		5,961
Sounding ranges established and located	1,110	4,395		5,505
Number of ranges sounded	1,054	4,451		5,505

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Items.	Year ending June 30— 1903.	1904.	1905.	Total to June 30, 1905.
Hypsometry.				
Miles of duplicate levels	165.5	116.9	9.9	292.3
Miles of single line	256.2	668.4	28.7	943.3
Total miles of single line	587.2	897.2	35.1	1,519.5
Bench marks established	256	336	7	591
Old bench marks determined	.....	64	.....	64
Water gauges determined	20	125	.....	145
Sounding pegs determined	520	1,167	.....	1,687
Borings.				
Number of holes drilled	.....	509	60	569
Total depth drilled below river bottom.....feet	.....	12,059	578	12,637
Average depth drilled below river bottom.....do	.....	23.7	.....	23.7
Average depth drilled below low water.....do	.....	33.2	.....	33.2
Field maps.				
Triangulation stations platted	270	800	.....	1,070
Ranges of soundings platted	1,108	4,397	.....	5,505
Square miles of topography platted	290.0	392.7	.....	682.7
Square miles of contours drawn	240.0	442.7	.....	682.7
Square miles of contours checked	228.8	453.9	.....	682.7
Final maps.				
Nos. 1 to 49, inclusive:				
Triangulation stations platted	92	994	.....	1,086
Square miles of topography transferred	44.5	638.2	.....	682.7
Square miles of topography inked in	23.0	659.7	.....	682.7
Lines of soundings platted	.....	5,505	.....	5,505
Lines of soundings inked in	.....	4,830	675	5,505
Test borings platted and inked	.....	.....	514	514
Maps of 1899–1900 (Nos. 50 to 57, inclusive):				
Triangulation stations platted	.....	.....	51	51
Lines of soundings erased and replatted	.....	.....	1,044	1,044
Towns or additions platted and inked	.....	.....	18	18
Square miles of topography platted and inked	.....	.....	20.7	20.7
Scattered data:				
Miles of railroad platted and inked	.....	.....	155.6	155.6
Miles of canal platted and inked	.....	.....	12.8	12.8
Miles of highway platted and inked	.....	.....	45.7	45.7
Miles of private road platted and inked	.....	.....	12.3	12.3
Miles of shore line platted and inked	.....	.....	12.5	12.5
Miles of creek platted and inked	.....	.....	22.0	22.0
Miles of fence platted and inked	.....	.....	225.9	225.9
Number of buildings platted and inked	.....	.....	708	708
Number of bridges platted and inked	.....	.....	21	21
Number of ferries platted and inked	.....	.....	4	4
Number of borings platted and inked	.....	.....	110	110
Number of section corners platted and inked	.....	.....	4	4
Number of names added	.....	.....	591	591
Publication maps.				
Triangulation stations platted	.....	.....	217	217
Number of negatives made	.....	.....	198	198
Number of prints made from negatives	.....	.....	207	207
Square miles of topography transferred	.....	.....	1,224	1,224
Square miles of topography inked in	.....	.....	1,224	1,224

SECONDARY TRIANGULATION.

The latitude and longitude of 76 secondary triangulation stations were recomputed between Grafton and Chicago in an effort to account for a discrepancy of 19 seconds in azimuth at Grafton between the values obtained by the Mississippi River Commission and those carried down from Chicago on this survey. No error was found in the computations of our own work.

In pursuance of the authority secured from you in August, the steamer *Pearl* was furnished with a crew and left Beardstown on September 8 for the purpose of setting 18 additional permanent monuments at tertiary triangulation points where the secondary stations are comparatively inaccessible. This work was completed on September 27, the steamer *Pearl* transferred to Asst. Engineer C. V. Brainard at Beardstown, Ill., and the party disbanded, except Mr. Henry Fox, who returned to the Peoria office to resume work on the computations connected with the triangulation.

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The latitudes and longitudes of 120 secondary triangulation stations and 16 tertiary triangulation stations were stamped upon the bronze caps covering the iron pipes. This includes all of the permanent stations marked by stone and pipe between Chicago and Grafton, excepting those at Lagrange lock and Liverpool, which were omitted because they were under water at that time.

The permanent monument at triangulation station "Peoria Heights," which was removed during October, 1904, by the park board of Peoria on account of constructing a new driveway, was reset upon the completion of that improvement.

Copies were made in triplicate of Table No. 1, consisting of 36 pages, and Table No. 2, consisting of 56 pages. Table No. 1 gives the observed angles, the plane angles, logarithm sines, logarithm sides in feet and meters, and the triangle sides in feet and meters of 201 triangles, 27 of which belong to the secondary triangulation system of the Chicago Sanitary District. Table No. 2 gives the latitude and longitude and seconds in feet and meters of 273 points, of which 27 belong to the secondary triangulation system of the Chicago Sanitary District and 67 are buildings; also the azimuth, back azimuth, and distance to the adjoining stations. The descriptions were revised and typewritten in triplicate of 172 permanent triangulation stations.

All permanent triangulation stations were platted and checked on the original index sheet to the final maps, from which a tracing was prepared showing a diagram of the entire secondary triangulation system as well as all permanent tertiary stations. On the same map and tracing are shown the Illinois and Des Plaines rivers and all adjoining towns. The names and figures were stamped on the original drawing and tracing.

Descriptions, latitudes, and longitudes were prepared in duplicate for the United States Geological Survey of 15 secondary triangulation stations included in the reach from 7 miles above to 18 miles below Peoria.

PRECISE LEVELS.

The elevations of the precise-level bench marks between Chicago and Grafton, 139 in all, were stamped upon the bronze caps covering the iron pipes, or upon the lead surrounding the copper bolt in cases where there was no pipe.

A tabulation was prepared of the distances between consecutive bench marks on the line of precise levels from Grafton to Chicago, with summation of the same from Grafton to Peoria and from Peoria to Chicago. The length of the main line is 334.52 miles. The length of the side lines is 14.41 miles.

The descriptions of 726 permanent bench marks and temporary bench marks were revised and rewritten in triplicate, to accompany the final report.

The results of the precise leveling were tabulated, checked, and typewritten in triplicate for 726 permanent bench marks and temporary bench marks.

At Chicago the line of levels was closed on United States permanent bench marks 99, 98, and 96, which were established in 1883 by the Mississippi River Commission, with the following results:

Elevation above Cairo datum.

Bench mark.	Mississippi River Commission, 1883.	United States Corps of Engineers, 1904.	Discrepancy.
	Meters.	*Meters.*	*Meters.*
U. S. P. B. M. 99	186.8673	186.46076	0.09346
U. S. P. B. M. 98	188.4896	188.50984	.09024
U. S. P B. M. 96	188.4379	188.52807	.09017
Mean			a.08796

a Equals 3.463 inches.

Seventy-four pages of notes and computations relating to the determination of the constants of the instruments and length of rods used in the precise leveling were copied into the precise-level field books.

The descriptions and elevations of 154 permanent bench marks and temporary bench marks in the vicinity of Naples, Beardstown, Havana, Pekin, and Peoria

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were typewritten in duplicate and checked for the use of the United States Geological Survey. Descriptions and elevations of 15 precise-level bench marks were copied for and at the request of the superintendent of the Toledo, Peoria and Western Railway.

TOPOGRAPHY.

During the preparation of the final maps from the field sheets a record was made of all places where the data on hand seemed to be incomplete. Tracings were made of these portions of the maps and men were sent into the field to supply the missing data. At the same time 892 additional names of landowners were secured, which it was impractical to obtain during the general survey without delaying the larger parties. The clumps of guide piles, which were driven at 8 bridges across the Illinois River during the year 1904, were located. Additional stadia readings were taken on 8 creeks, 2 sloughs, and 6 timber lines; 220 additional fences and 131 houses were located. Most of the latter were on the higher side of the bluff roads, and were intentionally omitted by the topographers at the time of the original survey. The elevations were determined of the lowest portions of all of the bridges across the Illinois River.

The matter of revising the maps of 1899–1900, in accordance with the instructions of the Board, proved a very troublesome proposition and caused much delay in the completion of the work. These maps cover the valley from Peru to Lockport.

It was known to the secondary triangulation and wye-level parties that the Sanitary District of Chicago had made detached surveys at a number of places on account of certain damage suits which had been filed against them. Before undertaking to obtain any additional topography along this part of the river it was considered advisable to obtain blueprints of these recent surveys made by the Sanitary District, in order to avoid needless expense in covering the same ground twice in the same year. Accordingly, a request for these maps was sent to the office of the Sanitary District early in September, 1904. In reply I was assured that the matter would receive prompt consideration. Under various pretenses, however, which it is unnecessary to repeat here, the delivery of the maps was postponed from time to time, and it was not until November 28 that the first batch of blueprints were delivered at our Peoria office.

The Sanitary District maps were drawn to a larger scale than the maps of this survey, and as it was evident that the work had been done carefully and thoroughly, the maps of 1899–1900 were corrected and amended accordingly, as explained more fully under the heading "Final maps."

The territory covered by these maps having been determined, a topographical party was sent into the field on December 7 for the purpose of securing the necessary additional data between Peru and Lockport. Three transit lines were run from the upper part of Lasalle to the lower part of Peru, locating the corners of the blocks and various manufacturing plants. Stadia surveys were also made in the vicinity of Seneca, Morris, Joliet, and Lockport. This party was disbanded on January 7, and thereafter the work of comparing the old maps with the present topography was carried on by two junior engineers, working separately, without parties. As far as possible the work accomplished has been embodied in the following table, but considerable miscellaneous data were secured, which it is impossible to tabulate.

Table showing additional data secured in the field from Peru to Joliet for revising the maps of 1899–1900.

Towns or additions	5	Number of bridges	12
Square miles of topography	8.4	Number of ferries	4
Miles of railway	39.5	Number of section corners	10
Miles of highway	16.4	Names of islands	34
Miles of fence	151.7	Names of rivers and creeks	42
Miles of shore line	8	Names of lakes and sloughs	60
Number of buildings	143	Names of owners and tenants	435

On February 21 a party was sent into the field to stake out and cross section the line of the proposed canal opposite Marseilles. The center line, as staked out, was found to be 3.1 miles in length.

The line of the proposed waterway, from the point where it leaves the present Illinois and Michigan Canal, below Joliet, to the point where it enters the Des Plaines River, below the Brandon Bridge, was staked out on the ground, a distance of 5,770 feet.

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HYPSOMETRY.

About half of the wye levels, which are reported for the present year in the tabulation at the beginning of this report, were run between Joliet and Utica, to determine additional high-water marks of 1902 and 1904, as the data on hand were not sufficient to permit these lines to be drawn accurately on the profile.

On February 1 a level party was sent into the field to determine the amount of land which would be overflowed along the Kankakee River by the proposed dam just below its mouth. Levels were run from the mouth to within 1 mile of the Santa Fe Railway bridge. In addition to these levels, 16 cross sections of the valley were taken at 1,000-foot intervals.

Forty-five cross sections were taken of the proposed canal opposite Marseilles, and 32 cross sections of the river and proposed canal at Joliet, Ill.

The descriptions and elevations were compiled and copied of 685 wye-level bench marks.

TEST BORINGS.

The work of making test borings between Grafton and Lasalle was completed on July 2, 1904, and the party disbanded. On July 22 the boring boat with the boring outfit and blacksmith shop were temporarily transferred to Capt. Wm. B. Ladue, secretary of the Mississippi River Commission, and the rest of the equipment to Asst. Engineer C. V. Brainard, and the necessary receipts taken from each.

One hundred and nine additional sample bottles were filled and labeled, showing the character and amount of the material encountered in making the test borings, making the total number of bottles so prepared 160. The depth and character of the various strata were also filled in on the final maps for all of the holes drilled between Grafton and Peru, a total of 517.

Of the 60 borings shown in the tabulation at the beginning of this report as having been made during the year ending June 30, 1905, 8 holes, aggregating 202 feet in depth, were made in the river bed in the vicinity of Pearl and Montezuma; 14 borings and test pits, amounting to a total depth of 211 feet, were made along the line of the proposed canal opposite Marseilles; and 38 borings and test pits, aggregating 165 feet in depth, were made along the east and west bank of the Des Plaines River in the vicinity of Joliet.

DISCHARGE MEASUREMENTS.

The taking of discharge measurements was continued until the river fell to an ordinary low-water stage about the middle of August. As the stage remained practically stationary after that, the observations were discontinued.

During July and August, 2 measurements were taken at Pearl, 6 at Beardstown, 6 at Havana, 2 at Peoria, 4 at Henry, 4 at Ottawa, and 2 at Divine. Ninety-three discharge measurements were reduced and checked.

Forty-four curves were platted, showing the variation in the velocity from the surface to the bottom of the river for 44 different discharge measurements. The relation between the average velocity and the observed velocity at six-tenths of the depth was then determined for each set of measurements. These ratios were then utilized in correcting the original computations, which were based upon measurements taken at six-tenths of the depth.

Nineteen curves were platted, checked, and inked, showing the discharge of the river at Twelvemile Island, Kampsville, Pearl, Lagrange lock, Beardstown, Havana, Peoria, Henry, Peru, Lasalle, Ottawa at the Chicago, Burlington and Quincy Railroad bridge, Ottawa above Fox River, Morris, Divine, Kankakee Cut-off, Channahon, Willow Springs, Riverside, and Des Plaines.

The eight points at which measurements were taken on this survey are enumerated in the second paragraph of this section, with the exception of Twelvemile Island. The other measurements platted were taken under the direction of the United States Geological Survey, the Sanitary District of Chicago, and the United States Engineer Department under previous surveys. The measurements of each are represented by a special symbol.

Reference should be made to the fact that at Havana and Peoria, where measurements were taken at the same sections by this survey and by the United States Geological Survey, the discharge curves diverge. The results agree fairly well for ordinary stages, but at high water our curves give greater discharges than those of the United States Geological Survey. In my opinion this is accounted for by the fact that the observers of the United States Geological

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Survey used small Price current meters, with comparatively light weights, and we know from our own observations that the meters were deflected out of a vertical position very materially. This, of course, resulted in the meters recording a lower velocity than actually existed. It is believed, therefore, that the results obtained on this survey with a large Price current meter and a 60-pound weight are more reliable.

It should also be stated that our measurements were taken from a cable away from the disturbing influences of the bridge piers, whereas their meters were suspended directly from the bridges in taking observations.

The discharge measurements and curves were traced on a single sheet about 43 inches wide and 12 feet long. Elevations in feet above Memphis datum are represented on the long edge, and the discharge in cubic feet per second crosswise of the sheet. All of the lettering and figures, including the title, notes, and authorities, were stamped on both the original drawing and tracing.

Inasmuch as the maximum discharge of the Illinois River has heretofore been a disputed question, it may be well to add here that, when the flood of 1904 was at its highest, a discharge of 115,000 cubic feet per second was measured at Pearl, Ill., 42 miles above the mouth.

The following discharge measurements were compiled and typewritten in quadruplicate, one set for the Mississippi River Commission and three to accompany the final report:

Survey of Illinois and Des Plaines Rivers; six sheets, covering measurements taken at Twelvemile Island, Pearl, Beardstown, Havana, Peoria, Henry, and Divine, in 1903 and 1904.

Survey of Illinois and Des Plaines rivers; three sheets, covering measurements taken at Ottawa and Morris on Illinois River, and of Fox River at its mouth, in 1900.

United States Geological Survey; seven sheets, covering measurements taken at Havana, Peoria, Lasalle, Ottawa, Divine, Kankakee Cut-off, and Jackson Creek, in 1903 and 1904.

Sanitary district of Chicago; three sheets, covering measurements taken at Morris, in 1892.

FIELD SHEETS AND FINAL MAPS.

In addition to the work shown in the tabulation, the following was accomplished during the year just closed, viz:

About 1.3 square miles of topography were transferred from one of the maps of the Mississippi River Commission, showing the islands and west shore of the Mississippi River at the mouth of the Illinois River. Additions were platted and inked to the towns of Henry, Hennepin, Bureau, and Spring Valley.

One hundred and six additional section corners were platted on the field sheets and final maps, based upon a number of corners located in the field during the month of June, 1904.

Four hundred and sixty-two bench marks were platted on the field sheets and final maps, and the platting checked of 608 bench marks.

The supplemental data enumerated in the first paragraph under "Topography" was platted on the field sheets and final maps.

The center line and side lines of the proposed 14-foot waterway were platted and inked in from Grafton to Lockport, a distance of 293 miles. From Grafton to Peru the bottom is shown 300 feet wide, and from Peru to Lockport 200 feet wide. The final estimates, however, are based upon a bottom width of 200 feet for the entire distance. One thousand-foot stations and the distances in miles were platted, checked, and inked for the entire distance.

Border lines and section lines were platted and inked on 40 of the 58 final maps. This work was done on the other 18 maps during the preceding fiscal year. The parallels and meridians were platted and inked on all of the 58 final maps.

The lettering was stamped on 42 of the final maps, the other 16 having been stamped during the previous year. The contour elevations were stamped upon 49 of the maps, and bench marks, borings, and titles upon the entire 58 maps. All water surfaces were tinted light blue on the entire series.

An index map to the 57 final maps was drawn and inked to a scale of 1 inch to 4 miles. The parallels and meridians were drawn at six-minute intervals, based upon the polyconic projection, but were inked in only for twenty-minute intervals. This map shows the Illinois and Des Plaines rivers, the Illinois and Michigan Canal, the Chicago Sanitary Canal, the principal lakes and tribu-

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taries, bluff lines, county lines, 72 cities, towns, and villages, and the distances in miles from Grafton to Lake Michigan. The stamping on this map was finished on May 3, thereby completing the preparation of the 58 final maps.

During the process of photolithographing, which is referred to in detail further on, all of the maps were considerably soiled. These were all recleaned when returned from the printery.

All of the maps have a uniform width over all of 43 inches, but on account of the shape of the valley it was impracticable to make them uniform in length without having a large amount of blank space on some of the sheets. The lengths are as follows: 39 sheets, 12 feet long; 13 sheets, 10 feet long; 6 sheets, 6 feet long.

Maps Nos. 50 to 57, inclusive, are referred to further under the next heading.

MAPS OF 1899–1900.

In accordance with the instructions of your Board, these maps were adopted as part of the present series, and revised and corrected to date. These sheets, which were originally numbered from 1 to 8, inclusive, were renumbered so as to constitute Nos. 50 to 57, inclusive, of the new series.

These maps were originally prepared under the direction of a Board of Engineers consisting of Col. J. W. Barlow, Maj. J. H. Willard, and Maj. C. McD. Townsend, from surveys made in 1899–1900 by F. M. Towar and James A. Seddon, United States assistant engineers.

During July and August, 1904, the secondary triangulation stations, parallels, meridians, and border lines were platted and inked, and the sheets cut to the standard width of 43 inches.

In accordance with your instructions, the lines of elevations, which were shown across the bed of the river at intervals of about 500 feet, were all erased and replaced by soundings showing the depth in feet and tenths below the low water of 1901—the lowest since the opening of the Chicago Sanitary Canal.

It is believed that the contours as shown are as nearly correct as on most other maps of this character. However, a careful study of the maps showed that much desirable data was lacking. For example, there are shown about 45 tributaries to the Illinois and Des Plaines rivers between Peru and Lockport, only 3 of which were named. More than 50 islands were shown in the same distance, only 1 of which was named. It was also found that in certain places the entire valley had not been platted—that is, not up to the high-water level of 1844, which was the standard adopted for the territory between Grafton and Lasalle.

As explained under "Topography," a number of blueprints were obtained from the Sanitary District of Chicago showing tracts surveyed by them during 1904. These prints covered the area from the head of Treats Island to the Kankakee Cut-off, on both sides of the river, and from a point 1 mile above Morris to the Seneca Bridge, on the south side of the river, and several small detached tracts. These were carefully compared with the maps of 1899–1900, and the necessary corrections and additions made. The contours were not changed unless the number and position of the stadia elevations on the Sanitary District maps made it probable that their contours were more nearly correct than those on the Government maps.

Tracings were made from recent plats of Peru, Lasalle, Utica, Ottawa, Marseilles, Morris, Channahon, and Rockdale. After comparing these plats with the towns on the ground to see what portions were actually improved, the necessary additions were made to our own maps.

The additional topography taken in the field in the vicinity of Peru, Lasalle, Seneca, and Morris was first platted on field sheets and then transferred to the large maps. The other miscellaneous data secured in the field and from many private sources, such as railroads, towns, manufacturing establishments, etc., were platted directly on the large maps.

The areas which will be permanently damaged after the construction of the proposed dams were inclosed in heavy broken blue lines. These lines include all lands up to a height 1 foot above the low-water levels in the pools.

All of the proposed locks and dams, including projects A, B, C, and D, were platted and inked in.

The original lines on these eight maps were drawn too fine to give a good reproduction by photolithography. Therefore, after cleaning the maps thoroughly on both sides, all of the original lines were retraced. In the case of

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the contours this was a tedious and difficult job. All of the original lettering and figures were also retouched.

The following table shows the additional amount of stamping done on the maps of 1899–1900 so far as it could be tabulated:

Names of islands	34
Rivers, creeks, lakes, etc	128
Names of streets	523
Names of railroads	42
Triangulation stations	51
Bench marks	223
Section corners	379
Distances, miles, and stations	447
Water surfaces, radii, gauges, etc	345
Test borings	116
Contour elevations, square miles	36
Landowners and tenants	907
Miscellaneous	736

PUBLICATION MAPS.

At the meeting of the Board held in the latter part of June, 1904, it was decided to prepare a second set of maps to a small scale for general use. It was decided that they should be drawn to a scale of 1½ inches to 1 mile, so that when reduced one-third in reproduction the published sheets would be to a scale of 1 inch to 1 mile and be similar in size to the maps of the Mississippi River. The maps as drawn are therefore 18 inches by 33 inches inside the border. I was also instructed to draw the contour lines in brown and to tint all water surfaces a light-blue color. The amount of detail to be placed on the maps was left to my judgment, to be decided as the work progressed. The scale of the index map to the series was fixed at 8 miles to the inch. For the want of a better name they have been called "Publication maps" in the ten-day and monthly reports, and the same designation has been retained here.

The construction of these maps was begun early in July by determining the arrangement of the sheets. It was found that exactly 13 sheets were required to cover the total distance from Grafton to Chicago. For use in construction parallels and meridians were drawn in pencil for each minute, based upon the polyconic projection. In inking the lines, however, only every third line was drawn, so as to cause as little interference with the topography as possible.

After giving the matter careful consideration, I decided that the cheapest and best way to effect the reduction in scale from the large maps to the small ones was by photography. One reason for this conclusion was due to the fact that the large maps covered so much area that a pantograph would have to be reset so frequently that much time would be lost in that way. As the drafting tables were only 5 inches wider than the large maps, much difficulty would also be experienced in keeping a large and small map on the same table, and for obvious reasons it was impracticable to work on the floor or make the tables wider. Another reason was the fact that there was only one pantograph in the district, and it was considered desirable to have at least four draftsmen work on the reproduction.

A 5 by 8 inch camera of my own was used in taking the photographs, so that the Government was at no expense for a machine. Cramer's "contrast plates" were used for negatives, and Eastman's "solio paper" for prints. Graphite impression paper and styli were used in transferring the lines from the silver prints to the publication maps.

One of the 12-foot maps can be photographed on two 5 by 8 inch plates, but in order to eliminate any distortion at the ends, three plates were used for each large map. To obtain the territory above Lockport, including most of the city of Chicago, the maps of the Sanitary District of Chicago were photographed. Recent municipal plats of Peoria and Joliet were photographed to a scale of 1½ inches to 1 mile, in order that the whole of those cities might be represented on the maps. Mr. C. A. Clement, junior engineer, is entitled to credit for his carefulness in photographing the maps to the proper scale.

During the year the topography has been transferred and inked in on the entire series of thirteen maps. As completed, the maps show all the information represented on the large maps, except the soundings, borings, and bench marks, and the contours are drawn 5 feet apart instead of 1 foot.

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An index sheet to the thirteen publication maps was drawn and inked to a scale of 1 inch to 8 miles. It was reduced by pantograph from the index sheet to the large maps and represents the same features which are shown on the larger index map. The parallels and meridians are shown at thirty-minute intervals.

The area platted on each map, and the amount of stamping which has been done up to June 30, 1905, is shown in the following table:

No. of map.	Area on map.	Lettering stamped.	Contours stamped.
	Sq. miles.	*Per cent.*	*Per cent.*
1	70	100	100
2	86	100	100
3	124	100	100
4	128	100	100
5	119	100	.....
6	89	25	.....
7	64	65	.....
8	56	.....	.....
9	68	.....	.....
10	70	.....	.....
11	31	.....	.....
12	124	.....	.....
13	235	.....	.....
Index map	.....	100	100
Total	1,224	.....	.....

No stamping has been done on maps Nos. 8 to 13, inclusive. The titles have been stamped on maps Nos. 1, 2, 4, and the index map. All water surfaces have been tinted light blue on maps Nos. 1 to 5, inclusive, and the index map.

In justification of the time required to execute the stamping on these maps, the following estimate has been prepared of the total amount of stamping on the entire series, based upon actual count of the stamping of three maps of average character. The amount of stamping on the index map was counted.

Counties, townships, ranges	381
Cities, towns, landings, ferries, etc	287
Churches, schools, post-offices, warehouses, clubhouses, depots, etc	241
Rivers, lakes, creeks, swamps, canyons	2,022
Islands, "miles," locks	693
Railroads	37
Triangulation stations	231
Latitudes and longitudes	349
Section numbers	5,003
Landowners	2,991
Contour numbers	8,753
Titles and notes (number of words)	1,550

PROFILES.

A general profile was platted and inked, showing the river from Grafton to the controlling works at Lockport, a distance of 293 miles. The vertical scale is 1 inch to 4 feet and the horizontal scale 1 inch to 4,000 feet. On the profile are shown the bottom of the channel, surface of the bed rock, both banks of the river, 630 test borings, and the following high-water and low-water lines:

High-water lines platted on general profile.

Year.	Inclusive points.	Distance.
		Miles.
1844	Grafton to Peoria	159
1858	Grafton to Meredosia	72
1883	Grafton to Treats Island	279
1892	Grafton to Joliet	289
1902	Grafton to Peru	224
1903	Du Page River to Joliet	12
1903	Grafton to Valley City	62
1904, May	Grafton to Apple Creek	38
1904, March and April.	Grafton to Joliet	290

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Low-water lines platted on general profile.

Year.	Inclusive points.	Distance.
		Miles.
1871	Henry to Peru	28
1873	Copperas Creek to Henry	59
1879	Grafton to Copperas Creek	137
1879	Henry to Peru	28
1883	Peru to Joliet	66
1894	Grafton to Henry	196
1901	Grafton to Joliet	290

Some of the lines were not drawn the entire distance, because the data on hand did not warrant it, while others were stopped when they ceased to be of special interest.

The proposed water surfaces, bottom grades, and the location of the locks and dams, under the proposed projects, are shown, as well as the towns, bridges, tributaries, and other points of interest. The profiles of the proposed lateral canals at Marseilles and Joliet are also shown.

The profile was traced on four sheets, 7½ to 9 feet in length. All lettering and figures, including the titles, were stamped on the original, as well as the tracings. For study purposes a second profile was platted and inked, showing the bottom of the river, the surface of the bed rock, the right and left bank, the low water of 1883 and 1901, and the high water of 1883, 1892, and 1904, from Peru to Lockport, a distance of 70 miles. On this profile was platted and inked Colonel Marshall's project of 1890, and the project prepared by the Board of Engineers in 1900.

For insertion in the report of the Chief of Engineers a small profile was prepared and traced to a scale of 1 inch to 30 miles, showing the bottom of the channel, the proposed grades, and the location and lift of the proposed locks. The same sheet shows five typical cross sections of the proposed waterway.

HYDROGRAPHS, ETC.

A tabulation was prepared for each of the following gauges, showing the number of days in each year, from 1894 to 1904, inclusive, that the water stood at successive stages above the low water of 1894:

Location of gauge.	Distance from Grafton.
	Miles.
Grafton	0.0
Kampsville, below and above dam	31.4
Valley City	61.6
Lagrange lock, below and above dam	77.6
Havana	120.0
Copperas Creek, below and above dam	136.8
Peoria	162.3
Henry, below and above dam	196.1

The following hydrographs were platted:

Location of gauge.	Inclusive dates.	Number of years.
Henry, below dam	1869–1904	36
Henry, above dam	1871–1904	34
Lasalle	1867–1883	12
Do	1896–1904	10
Ottawa	1883–1883	1
Do	1900–1904	5
Morris	1867–1867	1
Do	1896–1904	10
Joliet, below dam	1892–1904	13
Riverside	1886–1904	18
Total		136

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The number of years given in the last column does not check with the inclusive dates in some cases, on account of the fact that the gauge readings were missing for some of the intermediate years.

In addition to the above hydrographs, curves were platted, showing the fluctuation of the water surface, during the year 1904, at Grafton; Kampsville, below and above dam; Valley City; Lagrange lock, below and above dam, Havana; Copperas Creek lock, below and above dam; Peoria, and Jackson Creek.

WIDTH OF CHANNEL, AND PROPOSED WATER SURFACES.

The slope and low-water surface were computed and checked for a bottom width of 300 feet, based upon a Sanitary District flow of 10,000 cubic feet per second, at fifteen stations between Grafton and Peru. After a careful consideration of the discharge measurements taken at low water, the natural low-water flow of the river was taken at 500 cubic feet per second at Lasalle, and 1,000 cubic feet per second at the mouth. The computations were based on the removal of the dams now existing at Kampsville, Lagrange, Copperas Creek, and Henry. The stations for which the computations were made represent critical cross sections, i. e., each cross section is either smaller than any other in that reach or else a change of slope occurs at that point. Kutter's formula was employed, using for "n" a value of 0.025.

A special report was prepared, showing some of the advantages of a 300-foot channel as compared with a 200-foot channel, for that portion of the waterway from Grafton to Lasalle. The Board decided, however, that a bottom width of 200 feet was sufficient for navigation, and the slopes and low-water surfaces were recomputed on that basis. Computations were also made for both widths on a basis of 5,000 cubic feet per second from the Chicago Sanitary Canal.

The slope and proposed low-water surface of the river were also computed for ten stations between Utica and the mouth of the Kankakee River, based on a channel 200 feet wide on the bottom and a flow of 10,000 cubic feet per second from the Chicago Sanitary Canal.

EXCAVATION.

Three thousand and fifty-eight cross sections of the channel were platted for use in computing the amount of excavation necessary for the proposed waterway. The original instructions of the Board called for a bottom width of 300 feet, and the bottom grade and side slopes were drawn on that basis for 2,269 cross sections and measured and computed for 918 cross sections before the order was received to change to a bottom width of 200 feet. The prisms were, therefore, redrawn, and all of them measured and checked with planimeters.

The cross sections in the vicinity of Joliet show the Illinois and Michigan Canal, as well as the Des Plaines River. Those between Utica and Ottawa show two prisms, representing the different projects estimated upon. Forty-three additional cross sections were platted, measured, and checked of proposed levees under projects A and C between Utica and Ottawa.

Excavation computed.

Section.	Projects.	Inclusive.	Length.	Earth excavation.	Rock excavation.
		Miles.	*Miles.*	*Miles.*	*Miles.*
Grafton to Beardstown	Main	1.0– 88.0	88.0	88	0
Beardstown to Peoria	Main	89.0–163.0	74.0	74	0
Peoria to Utica	Main	163.0–229.0	67.0	67	0
Utica to Ottawa	A and C	230.0–241.0	12.0	3	9
Do	B and D	230.0–241.0	12.0	5	12
Ottawa to canal at Marseilles	Main	242.0–244.4	3.4	0	2
Canal at Marseilles	Main	244.4–247.6	3.2	4	4
Canal at Marseilles to Kankakee River	Main	247.6–276.0	25.4	28	4
Kankakee River to canal at Joliet	Main	274.0–285.3	12.3	11	7
Canal at Joliet	Main	285.3–288.4	3.1	4	3
River at Joliet	E	285.3–288.4	3.1	0	2
Do	F	285.3–288.4	3.1	2	2
Canal at Joliet to new power plant		288.4–291.1	2.7	0	2
Total				281	47

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Adding together the two totals given in the above table gives a grand total of 328 miles of excavation computed and checked. In addition to the above excavation, 14 miles of embankment were computed and checked.

LOCKS.

In accordance with your instructions, plans and estimates were prepared for locks 80 feet wide in the clear and 641 feet long between hollow quoins. The general design prepared by the Board of Engineers on Deep Waterways was adopted, except that granite hollow quoins and miter sills were provided for Lock No. 1 only. Five pairs of steel gates were provided for each lock, the weights of which were estimated by the formulæ derived in their report.

In designing the cross sections of the walls the factors of safety were computed abreast of the lock chamber and opposite the upper and lower gates. The size of the filling and emptying culverts were computed by different methods for all of the locks and dimensions adopted for the present plans and estimates.

The following drawings were prepared, inked, and traced, including the titles, lettering, and dimensions:

(1) Full-length plan and elevation of Locks Nos. 1 and 2, under the 14-foot project. Scale, 1 inch=10 feet.

(2) Three cross sections of each of the 12 locks under the 14-foot projects. Scale, 1 inch = 5 feet.

(3) Three cross sections of each of the 12 locks under the 20-foot projects. Scale, 1 inch = 5 feet.

Three cross sections were platted, measured, and checked of each of the 24 lock pits under these projects. Each cross section shows the amount of earth and rock excavation and the amount of back filling at that section.

A detailed estimate was prepared and checked for each of these 24 locks covering the following items: Masonry in walls and foundation, structural steel in gates, granite (or cast iron) in hollow quoins, anchorages and connections, valves and valve frames, oak timber in miter sills and gates, operating machinery, houses for superintendent and assistants, guide cribs, earth and rock excavation, back-filling, cofferdam, and pumping.

DAMS.

In accordance with your instructions, plans and estimates were prepared of movable dams of the chanoine wicket type, with wickets not to exceed 18 feet in length. No provision has been made for service bridges from which to operate the dams, the experience in this country having demonstrated that the wickets can be safely and readily operated from boats or scows.

The design prepared by Mr. F. B. Maltby, assistant engineer, for the proposed dam across the Mississippi River at Alton, Ill., seems to have embodied in it the best American practice along that line, and his design has been followed on this work.

Cross sections of the river were platted and inked in showing the seven proposed dam sites. From these cross sections the thickness of the concrete base and length of wicket were determined for each of the 9 proposed dams.

The following drawings were prepared, inked, and traced, including the titles, lettering, and dimensions:

(1) Three large cross sections showing details of the 9 proposed dams. Scale, ½ inch = 1 foot.

(2) Elevation of portion of the downstream side of dam with 18-foot wickets, showing details. Scale, ½ inch = 1 foot.

(3) Plan and elevation of dams with 18-foot chanoine wickets. Scale, 1 inch = 10 feet.

(4) Plan and elevation of dam with 12-foot chanoine wickets. Scale, 1 inch = 10 feet.

(5) Plan and elevation of dam with 10-foot chanoine wickets. Scale, 1 inch = 10 feet.

(6) Plans and elevations of the abutments of the 9 proposed dams. Scale, ½ inch = 1 foot.

A detailed estimate was prepared and checked of each of the 9 proposed dams, covering the items shown in the following statement: For the abutments—the amount of concrete masonry, earth, and rock excavation, back filling, and riprap; for dams proper—the amount of concrete masonry, structural steel, steel castings, cast iron, bolts and washers, oak timber, earth and rock excavation, cofferdam, and pumping.

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BRIDGES.

A table was prepared showing the following data concerning the 21 existing bridges between Lockport and Lasalle: Location, distance from Grafton, kind of bridge, number and length of spans, total length, total width, elevation of floor, nature of approach, and miscellaneous remarks.

Estimates were prepared of the cost of building or remodeling 7 railway, 10 highway, and 4 city bridges, in order to provide the draw spans necessary under the main project. Alternate estimates were prepared for 4 city, 3 railway, and 1 highway bridge, substituting trunnion bascule and rolling lift bridges in place of swing bridges.

An original and alternate estimate was also prepared for each of the 4 city and 1 railway bridge required at Joliet under a second project, making a total of 39 bridge estimates prepared.

Each estimate includes the following items: Structural steel, cast iron, machinery, interlocking plant, etc., for the superstructure; concrete masonry, earth and rock excavation, and cofferdam for the substructure, and such miscellaneous items as removal of old bridge, bridge protection, guide cribs, etc.

A table was then prepared showing the following information concerning the 21 proposed bridges between Lockport and Lasalle: Location; distance from Grafton; local name; type of bridge; clear width of roadway, sidewalk, and waterway; angle of skew; cost of substructure, superstructure, and miscellaneous items; total cost, and remarks.

For and at the request of Mr. C. V. Brainard, assistant engineer, the following tables were prepared concerning the bridges between Grafton and Lasalle:

(1) Table giving the gauge reading and elevation of water surface at each bridge during the low water of 1901.

(2) Table giving the elevation of the floor of each highway bridge, the base of the rail for each railroad bridge, and the lowest member for each bridge of either class.

(3) Table giving the character of each bridge, the clear opening of each draw span, and the motive power.

LANDS DAMAGED.

As stated in the section entitled "Maps of 1899–1900," the areas which will be permanently damaged after the construction of the proposed dam were inclosed in heavy broken blue lines. These lines include all lands up to a height 1 foot above the low-water levels in the pools.

These areas were carefully measured and checked with planimeters, and tables prepared showing the amount of land damaged on each side of the river and on the islands for each mile of the proposed waterway. Between Utica and Ottawa the areas to be damaged were measured for each of the four projects. This land has been estimated at $100 per acre, about twice the market value, to cover all possible contingencies.

RIGHT OF WAY.

The right of way required for the proposed canal opposite Marseilles was computed for a width of 600 feet. It was estimated at $150 per acre in order to cover miscellaneous expenses which may be incurred in securing it.

Estimates were prepared by George H. & Edwin S. Munroe, real-estate dealers of Joliet, of the value of 190 tracts of real estate in the city of Joliet, included in a strip 100 feet wide, along the east side of the Des Plaines River, and a strip 100 feet wide along the west side of the Illinois and Michigan Canal, and a plat prepared showing the character of the improvements on each lot. It was evident from these estimates that it was cheaper to widen the river on the east side than to widen the canal on the west side. The figures furnished by this firm were used in preparing the estimate for Project E.

SEVEN-FOOT AND EIGHT-FOOT PROJECTS FROM LASALLE TO OTTAWA, ILL.

Estimates were prepared and checked of the cost of locks, 75 feet wide in the clear and 350 feet long, between hollow quoins, for 7-foot and 8-foot channels from Lasalle to Ottawa, Ill. An original and alternate plan has been considered for each depth, making the lifts of the locks 6 feet, 7 feet, 9 feet, and 10 feet, respectively. The estimates include the masonry, gates, anchorages, valves and valve frames, cofferdams, earth and rock excavation, and back filling.

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Estimates were also prepared and checked of the cost of movable dams of corresponding heights. These were made in detail, covering the same items included in the estimates for the dams under the 14-foot projects.

Twenty cross sections of the river were platted, measured, and checked, and the amount of excavation computed and checked, for the 7-foot and 8-foot projects under the low-level plan. Under the high-level plan no excavation is necessary.

A summary of cost was prepared for two 7-foot and two 8-foot projects between Lasalle and Ottawa, covering the cost of locks, dam, bridges, and excavation.

PHOTOLITHOGRAPHING THE FINAL MAPS.

Proposals received in June, 1904, indicated that 100 sets of photolithographic copies of these maps, in two colors, could be obtained for less money than it would cost to trace the maps and furnish ten sets of blueprints. Among additional arguments in favor of photolithographing was the fact that with the draftsmen and office room available it was impossible to trace the maps within a year, in addition to the other work outlined by the Board. Upon the recommendation of the assistant engineer the Board decided to have the maps photolithographed, and on July 21, 1904, a contract was awarded to the Greeley Printery, of St. Louis, for furnishing 100 sets of each of the 58 final maps, in two colors, for $5,233.65.

The first four maps were sent to them on August 9, 1905. The first proofs submitted by them indicated that they did not have a proper conception of the accuracy required in the process of reproduction, and some trouble was experienced in bringing the work up to the standard desired. By critically testing and examining each proof, however, a very good set of reproductions has been secured. According to the statement of the company the high quality of the work required delayed the execution of the work, and it was not until June 28, 1905, that the contract was finally completed.

GAUGE RECORDS.

The work of compiling all the gauge records obtainable, relating to the Illinois and Des Plaines rivers, has been continued during the year, and a large number of additional readings secured. The following table gives the complete list of gauge readings compiled up to June 30, 1905:

List of gauge records compiled during survey of Illinois and Des Plaines rivers made in 1902–1905.

No.	Location of gauge.	Inclusive dates.
1	Grafton	Aug. 12, 1879, to Sept. 30, 1882.
	do	Apr. 1, 1894, to Dec. 31, 1904.
2	Deer Plain	Nov. 7, 1878, to June 30, 1880.
3	Hardin	Nov. 10, 1878, to June 30, 1880.
4	Columbiana	Nov. 4, 1878, to Oct. 16, 1880.
	Kampsville	Mar. 3, 1881, to Nov. 17, 1883.
	do	May 18, 1887, to July 31, 1888.
	Kampsville, below dam	Aug. 1, 1893, to Dec. 31, 1904.
	Kampsville, above dam	Sept. 10, 1893, to Dec. 31, 1904.
5	Pearl	Nov. 10, 1878, to Nov. 23, 1879.
	do	July 1, 1880, to May 14, 1881.
	do	Jan. 1, 1885, to Dec. 31, 1904.
6	Valley City	Nov. 1, 1878, to June 30, 1880.
	do	Dec. 18, 1888, to Dec. 31, 1904.
7	Meredosia	Nov. 1, 1878, to May 31, 1881.
	do	Jan. 19, 1894, to Dec. 31, 1904.
8	Lagrange lock site	July 19, 1892, to Dec. 31, 1899.
	Lagrange lock, below dam	Jan. 1, 1890, to Dec. 31, 1904.
	Lagrange lock, above dam	May 1, 1890, to Dec. 31, 1904.
9	Beardstown	Oct. 28, 1878, to May 31, 1881.
	do	Nov. 9, 1881, to June 26, 1884.
	do	Jan. 5, 1895, to Nov. 20, 1895.
	do	Mar. 1, 1896, to Dec. 31, 1904.
10	Browning	Oct. 10, 1903, to Dec. 31, 1903.
11	Sharps Landing	Oct. 26, 1878, to June 30, 1880.
12	Holmes Landing	Oct. 16, 1903, to Dec. 31, 1903.
13	Bath	Oct. 24, 1878, to Mar. 31, 1879.
14	Havana	Oct. 23, 1878, to May 31, 1881.
	do	Jan. 1, 1896, to Dec. 31, 1904.
15	Liverpool	Nov. 20, 1903, to Dec. 31, 1903.

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List of gauge records compiled during survey of Illinois and Des Plaines rivers made in 1902–1905—Continued.

No.	Location of gauge.	Inclusive dates.
16	Copperas Creek	Sept. 1, 1873, to Dec. 31, 1876.
	Copperas Creek lock, below dam	Jan. 1, 1877, to Dec. 31, 1904.
17	Copperas Creek lock, above dam	Oct. 6, 1877, to Dec. 31, 1904.
18	Kingston mines	Dec. 4, 1903, to Nov. 5, 1904.
19	Pekin	Apr. 1, 1892, to July 31, 1892.
	do	Apr. 1, 1898, to July 12, 1898.
	do	Mar. 1, 1899, to Apr. 20, 1899.
	do	Jan. 15, 1900, to Dec. 31, 1900.
	do	Mar. 1, 1901, to May 31, 1901.
	do	Mar. 1, 1902, to Oct. 31, 1904.
20	Peoria, P. & P. U. R. R. bridge	Mar. 10, 1903, to Dec. 31, 1904.
21	Peoria, lower free bridge	Jan. 1, 1867, to Sept. 30, 1871.
	do	Jan. 13, 1873, to Nov. 30, 1877.
	do	May 1, 1882, to Dec. 9, 1882.
	do	Apr. 17, 1883, to Apr. 30, 1883.
	do	Feb. 6, 1884, to Sept. 30, 1888.
	do	Apr. 1, 1889, to Dec. 31, 1904.
22	Peoria, upper free bridge	Feb. 6, 1894, to Dec. 31, 1904.
23	Chillicothe	Apr. 19, 1903, to Dec. 31, 1904.
24	Lacon	Dec. 5, 1903, to Oct. 31, 1904.
25	Henry	June 1, 1869, to Dec. 31, 1870.
	Henry lock, below dam	Jan. 1, 1871, to Dec. 31, 1904.
26	Henry lock, above dam	Sept. 18, 1871, to Dec. 31, 1904.
27	Lock No. 1, Illinois and Mississippi Canal	Nov. 22, 1903, to Oct. 31, 1904.
28	Peru	Mar. 20, 1889, to Nov. 30, 1889.
29	Lock No. 15, Illinois and Michigan Canal[a]	Jan. 1, 1867, to Nov. 30, 1877.
	do	Aug. 1, 1883, to Nov. 3, 1883.
	do	June 19, 1893, to Nov. 19, 1894.
	do	Apr. 1, 1897, to Dec. 31, 1904.
30	Lasalle, wagon bridge	Mar. 13, 1903, to Sept. 30, 1903.
31	Utica	Apr. 4, 1900, to Nov. 30, 1900.
32	Buffalo rock	July 30, 1883, to Nov. 10, 1883.
33	Lasalle, county farm	Apr. 1, 1900, to Nov. 30, 1900.
34	Ottawa, C., B. & Q. R. R. bridge	Mar. 12, 1903, to Feb. 13, 1904.
35	Ottawa, between bridges	Aug. 1, 1883, to Oct. 27, 1883.
36	Ottawa, wagon bridge	Jan. 17, 1900, to Dec. 31, 1900.
37	Ottawa, above Fox River	Mar. 19, 1889, to Nov. 30, 1889.
38	Flemming farm	Mar. 29, 1900, to Nov. 30, 1900.
39	Douglas farm	July 29, 1883, to Oct. 31, 1883.
40	Marseilles, above dam	July 29, 1883, to Oct. 27, 1883.
	do	Mar. 18, 1889, to Nov. 30, 1889.
	do	July 8, 1898, to Nov. 30, 1900.
41	Marseilles (3 miles east of)	Apr. 15, 1900, to Nov. 30, 1900.
42	Seneca, U. S. gauge	Apr. 21, 1900, to Nov. 30, 1900.
43	Seneca, C. S. D. gauge	Mar. 11, 1903, to Aug. 26, 1903.
44	Morris	Mar. 12, 1887, to July 30, 1887.
	do	June 20, 1893, to Mar. 31, 1898.
	do	Dec. 10, 1899, to Nov. 30, 1900.
	do	Apr. 20, 1903, to Dec. 11, 1904.
45	E. J. & E. R. R. bridge	Apr. 25, 1900, to Nov. 30, 1900.
46	do	Jan. 1, 1903, to July 9, 1904.
47	One-fourth mile above Kankakee River	July 29, 1883, to Nov. 3, 1883.
48	Kankakee feeder aqueduct	Jan. 20, 1904, to July 11, 1904.
49	Kankakee Cut-off	Jan. 1, 1903, to Dec. 27, 1903.
50	Three-fourths mile below mouth of Dupage River	Feb. 11, 1904, to July 14, 1904.
51	Mouth of Jackson Creek, U. S. gauge	Apr. 2, 1900, to Nov. 30, 1900.
	do	Apr. 17, 1903, to Dec. 31, 1904.
52	Mouth of Jackson Creek, C. S. D. gauge	Dec. 15, 1902, to Mar. 8, 1904.
53	Foot of Treats Island	July 29, 1883, to Oct. 27, 1883.
54	Head of Treats Island	July 29, 1883, to Oct. 27, 1883.
55	Joliet, below Adams dam, U. S. gauge	July 29, 1883, to Nov. 3, 1883.
56	Joliet, below dam, E., L. & P. gauge	Jan. 1, 1903, to Nov. 30, 1904.
	Joliet, above dam, E., L. & P. gauge	Aug. 1, 1901, to Nov. 30, 1904.
57	Joliet, above Dam No. 1, C. S. D. gauge	May 7, 1892, to Mar. 31, 1898.
58	Joliet, upper end Lock No. 5, I. C. C. gauge	July 6, 1893, to Nov. 20, 1894.
	do	Feb. 1, 1897, to Nov. 30, 1904.
59	Lockport, Ninth Street Bridge	May 28, 1900, to Nov. 30, 1904.
60	Willow Springs	Aug. 3, 1890, to Dec. 31, 1890.
	do	May 4, 1892, to May 14, 1898.
61	Riverside	May 15, 1886, to Dec. 28, 1889.
	do	July 24, 1890, to Dec. 27, 1890.
	do	May 3, 1892, to Dec. 31, 1904.
62	Des Plaines	May 26, 1887, to Dec. 31, 1889.
	do	July 22, 1890, to Dec. 31, 1890.
	do	Feb. 19, 1896, to Mar. 31, 1898.

A great deal of time and attention has been devoted to this feature of the work. All possible sources of information, so far as known, have been investigated. Government, State, and municipal offices have been searched; railroads,

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private corporations, and individuals have contributed whatever records they possessed. A historical sketch was prepared of each of these gauges, showing when and by whom it was established, the methods used in determining its elevation at different periods, and other important information.

The total number of sheets compiled is 561, exclusive of the 62 descriptions or sketches just mentioned. As a rule each sheet contains a full year's readings, but in some cases readings were taken only during the navigation season and in others only during the progress of some survey. The reading of the gauges established on the present survey was discontinued on December 31, 1904.

Second and third copies have been made of all of these sheets, so as to have three complete sets accompany the final report. Each set has been arranged in 26 files of convenient size, each of which was bound in manila covers and appropriately lettered.

MISCELLANEOUS.

A tracing was made from an original map and profile owned by the State canal commissioners showing the Illinois and Michigan Canal from Peru to Morris, Ill. This was used in considering the question of whether it was advisable to prepare an estimate for a 14-foot waterway via the line of the Illinois and Michigan Canal.

A tabulation was prepared and checked showing the high-water marks determined and compiled from Lockport to Grafton for each of the following years: 1844, 1849, 1851, 1858, 1866, 1883, 1887, 1890, 1892, 1902, and 1904.

Computations were made of the velocity of the current during the high water of 1892 and 1904 at thirteen points between Peru and Joliet. The velocity curves were platted for four of these points. These were prepared to determine what portions of the river would be rendered unnavigable during flood stages.

A complete list was prepared and checked showing the distances from the mouth of the river to all lights, landings, bridges, and towns along the Illinois and Des Plaines rivers and the Chicago Sanitary Canal between Grafton and Lake Michigan.

For and at the request of C. V. Brainard, assistant engineer, a tracing was made showing 6 square miles of territory in the vicinity of the Atchison, Topeka and Santa Fe Railway bridge, including contours and soundings.

A map of the Kankakee River Valley from the mouth of the river to the Santa Fe Railway bridge (a distance of 5 miles) was platted and inked on tracing cloth, showing the area to be overflowed by the proposed dam below the mouth of the Kankakee River.

A sketch map was drawn and inked in showing the waterways in northern Illinois and southern Wisconsin to a scale of 1 inch to 60 miles. This is designed to occupy one page of the Annual Report of the Chief of Engineers.

A table was prepared for the Sanitary District of Chicago giving the differences between Chicago datum and Memphis datum at all points from Chicago to Joliet where the precise levels of this survey were connected with those run by the Sanitary District in 1892.

For and at the request of the city engineer of Peoria, Ill., he was furnished with the descriptions and elevations of thirteen precise level bench marks located in the city of Peoria.

Written notices were issued announcing the sale of unserviceable engineer property at public auction at the Peoria office, on April 20, 1905. On the date specified all of the unserviceable property then on hand was disposed of and a statement and affidavit covering the same rendered in duplicate.

The titles were inked in on both ends of 28 rolls of profiles, cross sections, and hydrographs.

The limits of the territory covered by each field book were stamped on the covers of 442 different books.

An estimate was prepared of the cost of the proposed concrete wall 8,620 feet long, between the Des Plaines River and the proposed canal at Joliet.

The amount of earth and rock excavation was tabulated by miles and checked for each of the eleven sections from Grafton to Lockport into which the waterway has been arbitrarily divided. A summary was prepared for each of these eleven sections showing the cost of each of the following items: Earth excavation, rock excavation, embankments, locks, dams, bridges, right of way, and overflowed lands.

Two summaries were prepared showing the total cost of the proposed 14-foot waterway from Lockport to Grafton—one by sections and one by items.

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Work was continued on the computation of the cost of the various branches of the field and office work. Pay rolls, ten-day, monthly, and civil-service reports were prepared, quarterly returns of property rendered, accounts audited, cash statement rendered, and other clerical work attended to.

During the latter part of June the field books, maps, profiles, and miscellaneous data pertaining to this survey were packed in boxes preparatory to vacating the Peoria office. A portion of the office furniture, tools, and miscellaneous material were shipped to Beardstown, Ill., on June 29, and the remainder to Chicago, Ill., on June 30. The Peoria office was closed on the night of June 30.

REDUCTION OF THE FORCE.

The following civil-service employees, each of whom rendered faithful and efficient service, were laid off, furloughed, transferred, or resigned during the year on account of the completion of the work upon which they were engaged or for other good and sufficient reasons:

Name.	Title.	Date.
McGaughan, Henry T	Survey man	July 10, 1904
Foreman, Robert	do	July 23, 1904
Woermann, F. C	Junior engineer	July 27, 1904
Tudor, C. G	Draftsman	Aug. 13, 1904
Thogerson, T. C	Surveyor	Sept. 19, 1904
Hudson, W. D	Survey man	Do.
Harting, H. D	Junior engineer	Nov. 8, 1904
Webster, D. W	do	Nov. 9, 1904
Sessinghaus, E. F	do	Nov. 21, 1904
Falconer, G. C	Clerk	Dec. 31, 1904
Sargent, A. W	Junior engineer	Mar. 15, 1905
Emmons, C. L	Survey man	Apr. 15, 1905
Moskovitz	do	May 4, 1905
Rood, Elizabeth	Recorder	May 12, 1905
Marsh, Earl G	Junior engineer	May 13, 1905
Best, John H	do	May 25, 1905
Fox, Henry	do	May 31, 1905
Wheeler, A. C	do	June 8, 1905
Clement, C. A	do	June 6, 1905
Duis, F. B	do	June 16, 1905
Morley, Fred	do	June 23, 1905
Davenport, B. F	Draftsman	June 30, 1905
Hedstrom, E. A	do	Do.
Hauser, R. L	Survey man	Do.

On July 1 there remained on this work six employees: The assistant engineer and B. E. Dillon, recorder, engaged on the annual and final reports; W. Arthur Lafler, junior engineer, who will be employed about two weeks in finishing up some miscellaneous work; George W. Ramsey, O. W. Boers, and A. D. Llewellyn, employed in completing the stamping on the publication maps.

Very respectfully, your obedient servant,

J. W. WOERMANN,
Assistant Engineer.

Col. O. H. ERNST,
Corps of Engineers, U. S. Army, President Board of Engineers, Waterway from Lockport, Ill., to Mouth of Illinois River

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APPENDIX L L.

IMPROVEMENT OF ILLINOIS RIVER, ILLINOIS, AND CONSTRUCTION OF ILLINOIS AND MISSISSIPPI CANAL.

REPORT FOR THE FISCAL YEAR ENDING JUNE 30, 1905, WITH OTHER DOCUMENTS RELATING TO THE WORKS. OFFICERS IN CHARGE, MAJ. C. S. RICHÉ AND LIEUT. COL. W. H. BIXBY, CORPS OF ENGINEERS.

IMPROVEMENTS.

1. Illinois River, Illinois.
2. Operating and care of Lagrange and Kampsville locks, Illinois River, and approaches thereto.
3. Illinois and Mississippi Canal.

UNITED STATES ENGINEER OFFICE,
Chicago, Ill., July 15, 1905.

GENERAL: I have the honor to transmit herewith annual reports upon works in my charge for the fiscal year ending June 30, 1905.

Very respectfully, your obedient servant,

W. H. BIXBY,
Lieut. Col., Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

L L 1.

IMPROVEMENT OF ILLINOIS RIVER, ILLINOIS.

A high stage of water has prevailed throughout the year, rendering dredging unnecessary to maintain the 7-foot depth.

Repairs to the fleet have been continued, 3 dredges, 2 steamers, 4 barges, 4 scows, 1 pile driver, and 3 quarter boats having been repaired and worn-out parts renewed, the work being done by the regular force employed to maintain and operate the fleet. Five clumps of 5 piles each were driven above the ways at Beardstown to serve as a fender against ice and drift. One new barge was built.

A snagging trip over the river in August and September resulted in the removal of 120 snags.

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The modification of bridges ordered by the Secretary of War February 27, 1904, was in progress during much of the fiscal year and is nearly completed.

The work of the sanitary district of Chicago in lowering the dams at Kampsville and Lagrange was delayed by high water, and an extension of the time limit to May 23, 1906, was granted by the Secretary of War. By authority of the Department the sanitary district was allowed the use, free of cost, of 2 quarter boats, 2 barges, and 2 pumps belonging to the Illinois River improvement, in view of the fact that their work is practically in connection with the improvement of Illinois River.

A bar having formed in Illinois River at the mouth of Senachwine Creek by reason of the diversion of the creek channel by the Atchison, Topeka and Santa Fe Railway Company at their crossing near Chillicothe, a dredge, tender, and two scows were loaned to the railway company for the purpose of clearing the channel, authority having been granted by the Department.

The steamboat *Mary*, belonging to Richard Hulett, was sunk at Beardstown in a storm April 29, 1905, and no other plant being available for floating the boat, the owner was allowed the use of certain Government plant with which he succeeded in raising his boat.

Report of Junior Engineer J. R. Fuller is herewith. He deserves much credit for faithful and efficient services.

PROPOSED APPLICATION OF FUNDS.

It is proposed to apply these funds to maintaining the navigable channel of 7 feet depth between Copperas Creek dam and the mouth of the river, removing snags, care and repair of plant and property, and in making such local surveys as may be necessary from time to time.

Money statement.

July 1, 1904, balance unexpended	$65,122.18
June 30, 1905, amount expended during fiscal year, for works of improvement	21,255.91
July 1, 1905, balance unexpended	43,866.27
July 1, 1905, outstanding liabilities	1,500.00
July 1, 1905, balance available	42,366.27
Amount (estimated) required for completion of existing project	182,000.00

APPROPRIATIONS.

June 30, 1880, available from previous appropriations	$38,337.81
Act of—	
June 14, 1880	110,000.00
March 3, 1881	250,000.00
August 2, 1882	175,000.00
July 5, 1884	100,000.00
August 5, 1886	112,500.00
August 11, 1888	200,000.00
Joint resolution September 29, 1890	200,000.00

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Act of—	
July 13, 1892	$100,000.00
August 18, 1894	35,000.00
June 3, 1896	40,000.00
March 3, 1899	100,000.00
June 3, 1902	75,000.00
	1,535,837.81
Received from all other sources	535.40
Total	1,536,373.21
Expended to June 30, 1905	1,492,506.94
Balance unexpended June 30, 1905	43,866.27

COMMERCIAL STATISTICS.

Arrivals and departures of steamboats and barges at St. Louis, Mo., via Illinois River, calendar year 1904.

Month.	Arrivals.	Departures.	Receipts.	Shipments.
			Tons.	*Tons.*
March	4	5		
April	9	9		
May	9	8		
June	15	18		
July	21	22		
August	38	35		
September	18	19		
October	13	15		
November	19	11		
December	3	3		
Total	149	145	9,430	5,605

REPORT OF MR. JAMES B. FULLER, JUNIOR ENGINEER.

BEARDSTOWN, ILL., *July 1, 1905.*

COLONEL: I have the honor to submit the following report of operations for improving Illinois River for the fiscal year ending June 30, 1905:

The work for the year has consisted in keeping the river clear of snags and repairs to the floating plant. Owing to the good stage of water throughout the entire year no dredging was necessary. There is a navigable channel of approximately 7 feet at low water from Copperas Creek lock to the mouth of the river, except at the following places: Naples flats, just below Naples, where for about 1 mile the depth ranges from 6½ to 7 feet at low water, and French bar, just below Hardin, where for 1½ miles the depth ranges from 5 to 7 feet at low water. These shoalest places on French bar will probably cut out some if the stage of water gets low, as the fill is soft mud and the river narrows up very rapidly at low stages.

PLANT.

One new barge 4½ by 20 by 100 feet was built of Oregon fir.

CARE AND REPAIR OF PROPERTY AND PLANT.

Dredge Apache.—The work of repairing the hull of this boat, which was in progress at the beginning of the year, was completed, the following being accomplished: Relaid decking, fitted and bolted step for foot of boom and irons for guy-line fastenings, laid floor around boiler, rebuilt coal bunkers, calked and painted hull above water, and raised A frame and boom in position.

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Dredge No. 1.—This boat was hauled out and the following parts renewed: Top one-half of head block, one-half of truss posts in each gunwale, two-thirds of rake timbers, one-half of deck beams, all the rake and one-half of gunwale planking, top chord of rake, one spud-casing timber, chocks around spud casings, and all the decking. The hull was calked, painted two coats, and launched.

Dredge No. 2.—This boat was hauled out and the following parts renewed: One-third of head block, one-half of truss posts in each gunwale, all the rake and two-thirds of the gunwale planking, one-half the rake timbers, one spud-casing timber, and all the decking. The hull was calked, painted two coats, and launched.

Steamer Pearl.—This boat was hauled out and the following parts renewed: Seventy outriggers, 24 top timbers, and 90 square feet of gunwale planking; also all cylinder timbers, plank-sheer and nosing, and three-fourths of the decking. The hull was calked, painted two coats, and launched. The casing around the boilers was repaired and the boilers furnished with new grates, breeching, and smokestack. The cabin was painted one coat outside.

Steamer Fox.—This boat was hauled out and the following parts renewed: Bow stem, one-fourth of the top timbers, one-half the gunwale planking, 64 outriggers, all plank-sheer and nosing, one-fourth of the decking, both towing knees, and 6 cavils. The gunwales and deck were calked, the new work painted one coat, and the boat launched. A new smokestack was put on and the inside of the kitchen and engine room painted one coat.

Steamer Marion.—A new hull was built for this boat, painted two coats, and launched. The old cabin was moved on new hull and remodeled, being lengthened 5½ feet and widened 1 foot forward of the engine room. The pilot house was lengthened 36 inches and lowered sufficiently to allow the boat to pass under the bridges of the Illinois and Mississippi Canal. The carpenter work was practically finished and most of the machinery placed in position ready for use. The boilers were fitted with new grates, breeching, and smokestack, and the casing around them rebuilt. The cabin has been painted two coats inside and outside. The principal work remaining to be done is the wiring of the cabin for lighting, connecting steam pipes for heating cabin, and water pipes for supplying water to kitchen and closets.

Barge No. 1.—The repairs to this boat, which were in progress at the beginning of the year, were completed, the following work being accomplished: Finished the gunwales, rake deck and floor timbers, butting beams, stanchions and braces, planked rakes and deck, painted gunwales and rakes, and launched. This boat was built new except the bottom planking and center bulkhead.

Barge No. 2.—This boat was hauled out and two-thirds of the gunwales, all the rake and deck beams, and all the rake and deck planking renewed. The boat was calked and launched.

Barge No. 3.—This boat was hauled out and three-fourths of each gunwale, all the floor, rake, and deck timbers, stanchions, braces, and butting beams, and rake and deck planking renewed. The boat was calked all over, painted one coat, and launched.

Barge No. 108.—This boat was hauled out, calked, and launched.

Barge No. 4.—This boat was hauled out, two-thirds of the gunwales, all the rake and deck beams and the rake and deck planking, stanchions, braces and butting beams were renewed, and the boat calked, painted two coats, and launched.

Dump scow No. 6.—This boat was hauled out and had the gunwale and bulkhead planking, corner posts, one-fourth of each rake, 20 feet of one gunwale strake, and nosing renewed. Calked the rakes, gunwales, bulkheads, and lower one-fourth of the pocket decking, and launched.

Dump scow No. 5.—This boat was hauled out and the following parts renewed: Ends of bottom chords, rafters, one-third of gunwale strakes, pocket deck beams, gunwale, rake and top planking, and pocket decking. The boat was calked and launched.

Dump scow No. 7.—This boat was hauled out and the following parts renewed: Rake, gunwale and bulkhead planking, one-half of truss chords, all rafters and pocket deck beams, one-half of pocket decking, all top decking, nosing, and one door. The boat was calked and launched.

Dump scow No. 8.—This boat was hauled out and the following parts renewed: Ends of bottom chords, three top chords entirely, 15 inches of top of bulkhead, one-half of the rafters, two-thirds of the pocket deck beams, all the posts and two-thirds of the gunwale strakes, one butting beam, and all the planking except the bottom. The boat was calked and launched.

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Pile driver.—A new set of leads was built and mounted on a barge.

Quarter boat Margeret.—The roof was covered with roofing felt and painted and sanded.

Quarter boat No. 1.—The cabin was taken to Beardstown, moved on the bank, and used for a blacksmith shop and storehouse.

Quarter boat No. 2.—This boat was hauled out and one-half of one gunwale ane one-third of each rake renewed. This boat was calked and launched.

Office and quarter boat.—This boat was hauled out and is on the ways, some repairs being made to the hull.

Five clumps of five piling each were driven above the ways for fender piles as a protection from ice and drift.

Six trips of inspection were made over the river from La Salle to Grafton during the year.

SNAGGING.

Steamer *Pearl* made a trip over the river in August and September and cleared the river of snags, 120 being removed.

Very respectfully, your obedient servant,

JAMES R. FULLER,
Junior Engineer.

Lieut. Col. W. H. BIXBY,
Corps of Engineers.

L L 2.

OPERATING AND CARE OF LAGRANGE AND KAMPSVILLE LOCKS, ILLINOIS RIVER, AND APPROACHES THERETO.

These locks and dams have been operated and maintained under the indefinite appropriation provided by section 4 of the river and harbor act of July 5, 1884.

The revetment above the land wall at Lagrange lock was rebuilt and a windmill and tank erected.

The cut stone remaining from construction of Kampsville lock was broken up into rubble and hauled to the United States reservation, so that the leasing of land at Kampsville could be dispensed with. The lock gates were painted above water, the warehouse was repaired, and a windmill and tank erected. Rebuilding of river wall spar-track platforms was commenced.

The work of lowering the dams at Kampsville and Lagrange and providing them with movable crests has been commenced by the sanitary district of Chicago.

Detailed report of Junior Engineer James R. Fuller, in local charge of the work, is herewith, containing tables showing the number of boats navigating the river, the number of times they have passed the locks during the past fiscal year, and the tonnage of the various classes of goods.

PROPOSED APPLICATION OF FUNDS.

The funds to be allotted will be used for ordinary maintenance, repairs, and contingencies of service.

Summarized statement of expenses from appropriation for operating and care of canals and other works of navigation (indefinite) applied to Lagrange and Kampsville locks, Illinois River.

Lagrange lock:		
Services	$5,350.74	
Materials	94.08	
Supplies	18.86	
Total		$5,463.68

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Kampsville lock:		
Services	$5,607.38	
Materials	100.99	
Supplies	17.36	
Telephone	9.00	
Rent	19.25	
Travel	19.65	
Total		$5,773.63
Grand total		11,237.31

Money statements.

LAGRANGE LOCK.

July 1, 1904, outstanding liabilities	[a] $35.06
July 1, 1904, allotment for year 1905	7,500.00
	7,535.06
June 30, 1905, amount expended during year	5,463.68
July 1, 1905, balance unexpended	2,071.38
July 1, 1905, outstanding liabilities	562.75
July 1, 1905, balance available	1,508.63

KAMPSVILLE LOCK.

July 1, 1904, outstanding liabilities	$64.33
July 1, 1904, allotment for year 1905	7,500.00
	7,564.33
June 30, 1905, amount expended during year	5,773.63
July 1, 1905, balance unexpended	1,790.70
July 1, 1905, outstanding liabilities	572.04
July 1, 1905, balance available	1,218.66

COMMERCIAL STATISTICS FOR FISCAL YEAR ENDING JUNE 30, 1905.

	Tonnage passing—	
	Lagrange lock.	Kampsville lock.
Steamboats, number	545	444
Barges, do	285	143
Tonnage of steamboats, tons	105,647	114,388
Tonnage of barges, do	27,014	15,401
General merchandise, do	2,714	6,638
Passengers, number	12,827	16,660
Live stock, head	1,927	23,895
Corn, tons	2,576	
Wheat, do	3,640	1,483
Other grain, do	120	
Apples, do	84	138
Logs, do	3,915	3,228
Ties and wood, do		108
Coal, do	1,284	

[a] Erroneously reported $23.82 in last annual report.

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List of boats navigating the Illinois River during the fiscal year ending June 30, 1905.

Name.	Tonnage.	Trips past—	
		Lagrange lock.	Kampsville lock.
Gray Eagle	555	66	66
Bald Eagle	468	93	110
Lora	250	.....	12
J. S	236	7	7
Susan	198	13	10
Illinois	168	25	27
Verne Swain	98	38	38
Elenore	97	65	40
City of Peoria	128	22	6
Mary	50	88	30
Ebaugh	50	23	.....
H. W. Longfellow	47	27	2
R. G. Schmoldt	19	20	10
Belle of Ottawa	10	11	8
Imperial	95	4	.....
Blanche	48	.....	4

REPORT OF MR. JAMES R. FULLER, JUNIOR ENGINEER.

BEARDSTOWN, ILL., *July 1, 1905.*

COLONEL: I have the honor to submit the following report of operating and care of canals and other works of navigation on the Illinois River for the fiscal year ending June 30, 1905.

LAGRANGE LOCK AND DAM.

The river was open to navigation at this point a little over nine months out of the twelve, no boats passing the lock between December 12, 1904, and March 4, 1905, on account of ice. During the first six months of the year all boats passed through the lock. In March 17 boats passed over the dam, the others passing through the lock. From April 1 until May 20 four boats passed over the dam, the others passing through the lock. Since May 20 all boats passed over the dam except four on the 27th and 28th of June, these passing through the lock.

The revetment above the land wall was rebuilt; a tower for a windmill and tank was erected and the mill and tank put up; the summer kitchen of the superintendent's house was rebuilt and the house was painted inside and out.

KAMPSVILLE LOCK AND DAM.

The river was closed to navigation at this point by ice from December 15, 1904, until March 2, 1905. The first one-half of the year all boats passed through the lock. From the opening of navigation in March until May 21 six boats passed over the dam, the others passing through the lock. Since May 21 all boats passed over the dam.

The cut stone which was left from the building of Kampsville lock was broken up into rubble and hauled from the leased land and piled on the United States reservation. There was 609 cubic yards of this stone; the lock gates were painted above the water; a new roof of roofing felt was put on the warehouse, and a tower for windmill and tank erected and tank and mill put up. The rebuilding of the river wall spar-track platforms was commenced, but on account of delay in delivery of material was not completed.

The work of lowering the Lagrange and Kampsville dams by the sanitary district of Chicago, under permission granted by the Secretary of War, was commenced in the fall of 1904, but was suspended in January, 1905, and nothing has been done since. At Kampsville about one-fifth of the dam was lowered 2 feet and redecked, but no flashboards were provided for.

At Lagrange nothing was done beyond the delivery of part of the material.

There are herewith two tables, one showing the traffic by each lock for the fiscal year, the other showing the principal boats navigating the Illinois River, giving their tonnage and number of times each passed the two locks. In

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addition to the list of boats given, 58 other boats, with a tonnage varying from 4 tons to 200 tons each, made 101 trips, 36 of these being gasoline or steam yachts of less than 10 tons burden.

Very respectfully, your obedient servant,

JAMES R. FULLER,
Junior Engineer.

Lieut. Col. W. H. BIXBY,
Corps of Engineers.

L L 3.

ILLINOIS AND MISSISSIPPI CANAL.

The latter half of the year 1904 was favorable for work on the canal, and good progress was made by contractors, as well as by forces operating Government plant. In the spring of 1905 the work was several times interrupted by freshets, and work upon structures was considerably delayed. Contracts for earthwork are nearing completion, and it is expected that this class of work will be practically completed this season, with the exception of some cross banks at bridge sites and small remnants at bridge approaches.

The contract of the Savage Construction Company for constructing pits and foundations for four aqueduct bridges on western section was canceled, the contractors having shown themselves unable or unwilling to complete the work within the contract time, and the work was taken in hand by the United States to be finished at the expense of the contractor and his bondsmen.

The work of equipping the locks with gates and maneuvering gear was commenced; designs and specifications were prepared, contracts for metal work let, and much of the material delivered; timber has been ordered and delivery begun. Assistant Engineer C. V. Brainard was transferred from the Illinois River improvement and placed in local charge of construction of lock gates.

The question of lining for aqueduct trunks was brought up and carefully considered, resulting in a decision to substitute reenforced concrete in place of the proposed timber lining, and plans for the concrete lining were prepared and corrugated bars for three aqueducts were purchased.

The work in Cecils Slough, which has been in progress the entire year by hired labor and Government plant, has been greatly impeded this spring by wet weather, and latest reports indicate that more revetment than originally proposed will be necessary. The problem of carrying the canal through this slough has been considered at different times by the officer in charge and by a Board of Engineers (in 1901), and presents an interesting and difficult situation. The present plan of construction at this point was the result of the deliberations of a Board of Engineer officers, modified somewhat in the interest of economy as the experience of the officer in charge developed the conditions to be met. The plan of excavation by means of an overhead cableway is believed to be the only practicable method, and has been giving gratifying results up to a very recent date, when the question of drainage has become a controlling factor by reason of wet weather. The modification proposed by Maj. J. H. Willard in the plan of the Board of Engineers above referred to was partially

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experimental, as stated in his report upon the subject dated April 2, 1902. Further study of the questions involved is now in progress, and it can not be definitely stated at present that the plan heretofore adhered to can be carried to a successful end.

The charge for maintaining finished parts and structures of the canal has been somewhat smaller than for the preceding year. Much of the work was completed several years ago, and requires constant maintenance, for which no estimate was included in the original figures submitted for the cost of the canal. It has been necessary to patrol the banks on the eastern section during high water. Such items have necessarily been charged to the appropriation for construction of the canal, and are represented by the following amounts:

Eastern section:		
Fiscal year—		
1901	$1,960.85	
1902	5,747.83	
1903	14,638.28	
1904	3,924.20	
1905	3,765.66	
		$29,036.82
Western section and feeder:		
Fiscal year—		
1902	1,000.00	
1903	2,000.00	
1904	3,125.11	
1905	866.30	
		6,991.41
Moline wagon bridge		25,000.00
Total		61,028.23

The condition of the work in detail follows:

Feeder.—All earthwork, except removal of crossbanks and grading of six highway bridge approaches, has been completed. Seventy-two thousand four hundred and forty-seven cubic yards of rock have been excavated from mile 1 and used in riprapping slopes of the feeder, the east slope having been riprapped to mile 19 and the west slope to mile 22. Masonry of guard lock and controlling works has been completed, and a large amount of crushed stone and sand stored at aqueduct No. 9 for future use.

Work upon the aqueduct crossing Green River has been in progress during the year, and the excavation, foundations, masonry, backfilling, and slope paving completed. The aqueduct will be lined with reenforced concrete.

No progress has been made during the year on the dam across Rock River at the head of the feeder. Several conferences with the Sterling Hydraulic Company and their consulting engineer have been held. The engineer of the hydraulic company has made a series of measurements of the flow of Rock River and estimate of the probable increase in flood heights which will be caused by a change in the location and form of the dam. The Sterling Hydraulic Company claim that their interests will be largely damaged if the dam is built as proposed, and ask that it be built at the site of their present dam. This would give them the benefit of 9 feet additional head, and would obviate the necessity of building a lock to admit boats to the river front of sterling and Rock Falls. If this dam could be made fixed instead of movable, as originally proposed, it would be of greater

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benefit for power purposes, and its first cost and cost of maintenance and operation would be reduced to the United States. In such case, however, there would result additional flowage damages above the dam, and investigation is in progress to enable an estimate to be made of what the total additional damage would amount to, in order that the most economical course for the United States to follow may be determined.

At the close of the fiscal year a tentative agreement had been reached with the Sterling Hydraulic Company upon some of the points involved, but no definite proposition agreeable to both parties had been decided upon, and it is possible that no understanding can be arrived at covering all the points of difference and acceptable to both parties.

No apparent progress has been made during the year in the dispute over highway bridges on the feeder. The highway commissioners petitioned to have the bridges built in accordance with their demands and asked that the United States be prohibited from proceeding with the bridges under proposed plans. The cases were referred to a United States commissioner. The testimony has been taken and arguments heard before the master in chancery. The master completed his report March 1, 1905, in which all his findings were favorable to the United States. The report has not yet been approved by the district court. The delay in the construction of these highway bridges, due to litigation, has been expensive to the United States in various ways, and if an appeal is taken by the highway commissioners from the forthcoming decision still further delay will result. In such case the canal may have to be opened without the construction of these bridges, as originally proposed, and temporary low, level trestle bridges provided for the highway crossings of the feeder.

Western section.—All earthwork from feeder junction to and including mile 60 has been done or is under contract. Twenty-eight miles have been entirely completed, 4,324,727 cubic yards of earthwork having been executed. The deep cut at and below Colona is being excavated by hired labor and plant, consisting of steam shovel and railway equipment, owned by the United States.

The tracks of the Chicago, Rock Island and Pacific Railway Company at Colona have been raised, and abutments and superstructure of bridge over the canal have been completed to carry these tracks, and travel turned over the bridge. The Chicago, Burlington and Quincy Railway Company bridge, carrying their tracks over the canal at Colona, has been finished.

All of the culverts and bridge abutments on western section have been completed, and masonry and superstructures of twenty-four highway bridges completed, which includes all highway bridges except two which are to cross the tail-bays of locks. The foundations of six locks and the walls of five locks have been completed. All the rest of the masonry on the western section, foundations and superstructures of locks, and foundations and piers for aqueduct bridges have been finished or put under contract.

The Savage Construction Company, who had the contract for the pits and foundations for four aqueducts, proved entirely incapable of handling the work, and their contract was annulled and the work

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taken in hand by the United States. Plant was collected at Aqueduct No. 4, materials purchased, and operations begun; at Aqueduct No. 5, a pumping plant was installed, a pile driver was set up, and driving of piles commenced.

All steel and cast iron for Aqueducts 4 to 8, inclusive, was delivered.

Eastern section.—Work on the eastern section has consisted partly in maintaining the finished portions of the canal, and chiefly in excavating through Cecils Slough from miles 20 to 24, much of the material at this point being unstable. Miles 23 and 24 were completed. Farm bridge, near Lock No. 2, carried away by floating ice, was rebuilt; crevasses in the embankments were closed, ditches cleaned, banks dressed, and the work of excavating peat and unstable material on miles 20, 21, and 22 was pushed as rapidly as conditions would permit. Some of the work will have to be gone over again with the overhead cableway, as the banks slough and the cut is difficult to drain. Tile-drain was placed and intakes built to protect the banks from flood waters. Indications point to the necessity of docking on mile 22 and on parts of mile 21, and enlarging the section on the latter mile. The traction engine used on mile 22 was sold, under public notice and sealed proposals, by authority of the Department.

All of the earthwork on the eastern section has been practically completed, except on miles 20, 21, and 22, where 96 per cent of mile 20 and 73 per cent of mile 21 have been excavated. More material has been taken from mile 22 than was contained in the original estimate, but on account of increasing the bottom width and flattening the slopes considerable excavation yet remains to be done.

The work of maintenance becomes more considerable and more important as this section of the canal nears completion, and in times of high water it is necessary to patrol the banks.

All of the highway bridges from Nos. 1 to 18, inclusive, are complete except approaches to bridge 14. Three aqueducts have been completed, except woodwork, and three railroad bridges have been built. All masonry for locks, culverts, aqueducts, and highway and railway bridges has been completed.

The construction of lock gates and equipping them with maneuvering gear has been under way during the fiscal year. Contracts for material were made, most of the metal delivered, delivery of timber begun, and the work of framing was in progress at the close of the fiscal year.

PROPOSED APPLICATION OF FUNDS.

The funds now available, on hand, and to be appropriated are expected to complete the canal sufficient for opening to navigation, although possibly not until 1907.

For more detailed information reference is made to attached reports of Asst. Engineer L. L. Wheeler, resident engineer in charge of the western section and feeder, and of Asst. Engineer James C. Long, resident engineer in charge of the eastern section, and of Asst. Engineer C. V. Brainard, resident engineer in charge of construction of lock gates and equipment, all of whom deserve much credit for faithful and efficient services.

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Money statement.

July 1, 1904, balance unexpended	$1,041,878.91
Amount appropriated by river and harbor act approved March 3, 1905	300,000.00
Amount received from sale condemned property	1,175.21
	1,343,054.12
June 30, 1905, amount expended during fiscal year, for works of improvement	587,692.25
July 1, 1905, balance unexpended	755,361.87
July 1, 1905, outstanding liabilities	30,000.00
July 1, 1905, balance available	725,361.87
July 1, 1905, amount covered by uncompleted contracts	246,176.06
Amount (estimated) required for completion of existing project	200,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	200,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

July 1, 1890, balance unexpended from previous appropriations	$786.46
Act of:	
September 19, 1890	500,000.00
July 13, 1892	500,000.00
August 17, 1894	190,000.00
June 3, 1896	45,000.00
Sundry civil act—	
June 4, 1897	875,000.00
July 1, 1898	1,427,740.00
March 3, 1899	700,000.00
June 6, 1900	1,000,000.00
March 3, 1901	975,000.00
June 28, 1902	733,220.00
Act of March 3, 1905	300,000.00
	7,246,746.46
Received from all other sources	1,175.21
Total	7,247,921.67
Expended to June 30, 1905	6,492,559.80
Balance unexpended June 30,1905	755,361.87

Expenditures, Illinois and Mississippi Canal, for fiscal year 1905.

Eastern section, Illinois River to feeder junction	$128,130.44
Western section, feeder junction to Rock River	412,609.24
Feeder line	46,952.57
Total	587,692.25

Total expenditures, Illinois and Mississippi Canal, to end of fiscal year 1905.

Eastern section	$2,885,080.25
Western section:	
Around rapids of Rock River	547,229.93
Rock River division	25,470.21
Feeder junction to Rock River	1,598,351.28
Feeder line	1,436,428.13
Total	6,492,559.80

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LIST OF CONTRACTS IN FORCE DURING FISCAL YEAR ENDING JUNE 30, 1905.

[All appropriations, constructing Illinois and Mississippi Canal.]

Name and address of contractor.	Nature of contract.	Date.	To expire.	Remarks.
Callahan Bros. & Katz, Omaha, Nebr.	Earthwork, miles 58 and 59, western section.	July 16, 1902	July 31, 1903	Completed Dec. 12, 1904.
Page & Shnable, Chicago, Ill.	Foundations and walls for locks and piers and abutments for bridges.	Aug. 11, 1902	Nov. 30, 1904	Time limit waived.
Chicago Bridge and Iron Co., Chicago, Ill.	Superstructure, four highway bridges.	July 10, 1903	Dec. 31, 1903	Completed July 20, 1904.
Savage Construction Co., Chicago, Ill.	Pits and foundations for four aqueduct bridges.	Oct. 12, 1903	Sept. 30, 1904	Annulled Mar. 18, 1905.
Callahan Bros. & Katz, Omaha, Nebr.	Earthwork, miles 53-57, western section.	Apr. 16, 1904	Nov. 1, 1905	
Marquette Cement Manufacturing Co., Lasalle, Ill.	Furnishing 4,000 barrels Portland cement.	May 2, 1904	.....	Completed Nov. 14, 1904.
Wisconsin Bridge and Iron Co., Milwaukee, Wis.	Superstructure of one single-track steel railroad bridge.	June 9, 1904	Oct. 1, 1904	Completed Dec. 12, 1904.
Winston Bros. Co., Minneapolis, Minn.	Earthwork, parts of miles 34 and 60, western section.	June 21, 1904	Nov. 30, 1904	
A. E. Morton, Mineral, Ill.	Removing cross banks and building embankments at highway bridge sites, western section, Illinois and Mississippi Canal.	.....do.....	.....	Completed Dec. 7, 1904.
John Marsch.....	Earthwork, mile 22, eastern section.	July 26, 1904	June 30, 1905	Completed June 9, 1905.
Pittsburg Steel Construction Co., Pittsburg, Pa.	Superstructures of four highway bridges.	Aug. 4, 1904	.....	
Briar Bluff Coal and Mining Co., Moline, Ill.	Furnishing 500 tons of coal.	Sept. 13, 1904	.....	
Lawrence D. Weaning..	Lock gates, valves, gearing, etc.	Oct. 4, 1904	June 30, 1905	Time limit waived.
Springfield Bridge and Iron Co., Springfield, Ill.	Manufacture and delivery of aqueducts.	Oct. 11, 1904	.....do.....	
Modern Steel Structural Co., Waukesha, Wis.	Manufacture and delivery of sluice gates.	.....do.....	.....do.....	Do.
Do.....	Manufacture and delivery of Aqueduct No. 9.	Nov. 3, 1904	.....do.....	
Winston Bros. Co., Minneapolis, Minn.	Earthwork, mile 21, eastern section.	Nov. 9, 1904	.....do.....	Do.
Boeckeler Lumber Co., St. Louis, Mo.	Furnishing yellow-pine timber.	May 16, 1905	Sept. 15, 1905	
W. L. Serrell, Chicago, Ill.	Furnishing Oregon-fir timber.	.....do.....	Aug. 1, 1905	
Marsh & Bingham Co., Chicago, Ill.	Furnishing white-oak timber.	.....do.....	.....do.....	

REPORT OF MR. L. L. WHEELER, ASSISTANT ENGINEER.

STERLING, ILL., *July 8, 1905.*

COLONEL: I have the honor to submit the following report upon the work done on the Illinois and Mississippi Canal, under my supervision, during the fiscal year ending June 30, 1905:

FEEDER.

During the year no progress was made either in the design or construction of the dam across Rock River at the head of the feeder. The matter has been the subject of several conferences and of considerable investigation. At the request of Mr. D. W. Mead, engineer for the hydraulic company, a series of measurements of flow of Rock River at observed stages were made, and from this data Mr. Mead prepared a report upon probable increase in flood heights due to

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change in location and form of dam. An estimate of increased flowage damages, due to these increased flood heights, was made by myself.

During the year no progress was made in regard to the matters in dispute in regard to highway bridges over the first 22 miles of the feeder. The testimony in the case was completed and arguments made early in July before the master in chancery, to whom the matter had been referred for report and findings. The master completed his report March 1, 1905, in which all his findings were in favor of the United States. His findings have not yet been approved by the district court.

At the beginning of the year two cofferdams had been built for the crossing of Green River and the excavation of pits was in progress. The work was several times interrupted by freshets, but the excavation, foundations, masonry, back filling, and slope paving were completed. The steel for the aqueduct trunk was not delivered so that work of erection could be done. It is now all delivered and nearly all hauled to the aqueduct site.

It is proposed to line aqueduct trunks with reenforced concrete. Plans for this lining were prepared and corrugated bars purchased for three aqueducts.

WESTERN SECTION.

Work has been in progress during the year upon highway bridges over the main line. Under the contract with the Pittsburg Steel Construction Company, Bridge No. 36, a plate-girder bridge, was erected over Lock 24, and the material for Bridge No. 40, a special-lift bridge over Lock No. 26, delivered. Railings were built on the approaches to 11 bridges and approaches completed for travel.

The superstructure for the Chicago, Burlington and Quincy Railway Company over the canal at Colona was erected, the approaches completed, and travel turned over the bridge.

Under their agreement the Chicago, Rock Island and Pacific Railway Company completed the excavation of the canal under their bridge, built the retaining walls, completed the masonry for their bridge over Green River, and final payment was made to them.

The earthwork on miles 34 and 60, under contract with Winston Brothers, was completed, and final estimate made. A statement of loss to the United States, by reason of the failure of the Pound Construction Company to complete their contract for earthwork on mile 34, was made, and the matter placed in the hands of the Department of Justice. T. W. Kinser & Sons completed their contract for earthwork on miles 50, 51, and 52, and final estimate was made. Good progress has been made under the contract of Callahan Brothers & Katz for earthwork on miles 53 to 57, inclusive, and with fair weather this contract will be completed within one month. The last-named firm also completed their contract for earthwork on miles 58 and 59.

Work has been in progress during the year under the contract with Page & Shnable for construction of foundations of locks and walls of locks and aqueducts. The excavation and foundation for Lock 22 was completed and the forms for one wall erected. The walls for Lock 23 were built and back filling commenced. Slope paving was completed at Lock 25 and that at upper end of Lock 26 laid. The foundation for Lock 27 was completed, the walls built, and back filling done. The walls for Lock 28 were built, slope paving laid, and back filling done. The pit for Lock 29 was excavated, the foundation being on rock. The masonry for Aqueduct 7, excepting retaining walls, was built. The excavation for Aqueduct 8 was made, masonry built, and back filling done.

Under the contract of the Savage Construction Company for pits and foundations of aqueducts, the foundation for Aqueduct No. 7 was constructed. A portion of the excavation for Aqueduct 6 was made and the foundations for two piers for Aqueduct 5 put in, and the foundations for one other pier and one abutment partly put in. No work whatever was done at Aqueduct 4. On account of insufficient progress this contract was annulled and the work entered upon by hired labor. The necessary plant was collected at Aqueduct 4, materials purchased and delivered, sheet-pile cofferdams built, excavation commenced, and the piles for one pier driven. At Aqueduct No. 5 a pumping plant was installed, a pile driver set up, and driving of piles commenced.

Under the contract with the Springfield Bridge and Iron Company, for metal work of aqueducts, all the steel and cast iron for Aqueducts 4 to 8, inclusive, was delivered and hauled to the aqueduct sites. The erection of this metal work

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could not be commenced, as the rods for assembling were only shipped with the last shipments, which arrived about July 1.

During the year steam-shovel work has been in progress at Colona. Work was not resumed last season until in August, as the Chicago, Burlington and Quincy Railway could not be passed until the bridge was completed and travel turned over it. Work was suspended during the winter and was also interrupted for a short time in the spring by high water of Rock River. There remains to be excavated about 10,000 cubic yards of earth and about 5,000 cubic yards of rock. The work is so nearly completed that the following table of cost is of general interest:

Cost of plant		$34,515.43
Total operating cost		$71,502.29
Total yardage	cubic yards	513,700
Operating cost per cubic yard	cents	13.9
Total cost per cubic yard	do	20.6

Credit should be given to the above cost of 89,776 yards, at 25 cents per cubic yard, amounting to $22,440, for necessary embankments on site of present waste banks, made of material from deep cut. This practically amounts to about 4.4 cents per cubic yard on the 513,700 cubic yards excavated, making a total cost per cubic yard of 16.2 cents. On completion of the work the salvage from plant, which has been kept in good condition, should reduce the cost to approximately 15 cents per cubic yard. During the winter an estimate was made of the cost of all the various items of work remaining to be done and a special estimate of cost of completing the canal made. A large number of photographic prints were made and assembled in albums, copies of which were filed in this office and copies sent to the Chicago office.

During the year I have been assisted by Junior Engineers A. O. Rowse, M. G. Barnes, Fred W. Honens, J. B. Bassett, H. E. Reeves, J. H. Best, C. M. Waters, and by the following persons employed in clerical capacities: W. D. Powers, Paul Gillespie, Miss G. A. Deyoe, and Miss M. E. Ladd. I am indebted to all these persons for faithful performance of duties assigned them.

Very respectfully, your obedient servant,

L. L. WHEELER,
Assistant Engineer.

Lieut. Col. W. H. BIXBY,
Corps of Engineers.

REPORT OF MR. JAMES C. LONG, ASSISTANT ENGINEER.

WYANET, ILL., *July 8, 1905.*

COLONEL: I have the honor to submit the following report on work done under my supervision on the eastern section, Illinois and Mississippi Canal, during the fiscal year ending June 30, 1905:

MAINTENANCE.

Miles 1 to 17, inclusive.—The canal prism from the Illinois River to Lock No. 1, excavated with dredge in 1902, is exposed to a lateral current of water in the river which passes over it during high water, so soundings were taken to see if any deposit had been made in the part excavated. Rebuilt temporary farm bridge on the upper end of Lock No. 2, which had been destroyed by floating ice.

The embankment on mile 4 has been rebuilt where crevasse was made by high water in March, 1904, and cross sections taken in the canal to determine the amount of deposit made on miles 3 and 4 by these breaks in the bank.

At highway bridge No. 2 the drainpipe under the north approach was cleaned out and that part of the south approach which was washed away by high water, rendering the public highway impassable, has been rebuilt and a strong revetment of brush placed on the upper side to protect it.

During the high water in Bureau Creek, which occurred in April, 1905, the canal banks were patrolled, and a number of leaks were discovered on miles 4, 5, and 6, any of which, if not stopped in time, would have caused a crevasse in the embankment.

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The stone revetment between Slip Point and Lock No. 10 has been transferred and relaid and the banks dressed to a true slope to receive the concrete lining. About one-third of the gravel and all of the cement for the lining has been delivered.

The north seep ditch on the east end of mile 13 had become filled with a deposit of sand and gravel drifted from the hills, causing the water to overflow private property. This was opened up, and the land is now completely drained.

A 12-inch cast-iron pipe was placed under the Rock Island Railroad tracks to carry off the surface water and seepage through the canal banks near the west end of mile 16.

Mile 18.—Partially constructed the earth approaches to the farm bridge across the canal at Lock 21, amounting to 800 cubic yards; built the concrete substructure for the same, 18 cubic yards.

Mile 19.—Put in 268 square yards of concrete slope paving at Highway Bridge No. 12 for the protection of the bridge abutments. Reconstructed two intakes that were destroyed by frost and freshets.

Dressed and soiled the slopes of the cut on the west end of the mile where left incomplete by the Globe Construction Company, who abandoned their contract in 1898.

Mile 20.—Excavated 41,061 cubic yards of tenacious clay of the nature of hardpan from the cut through the hill on the west end of this mile with an elevating grader drawn by a traction engine, and with wheeled and drag scrapers. Moved the turntable dredge from mile 21 and put it in the bottom of the cut at the east end of this mile and began taking out the bottom, loading into flat cars. Twelve hundred cubic yards have been excavated in this manner at the end of the year. Dressed and soiled the slopes of the cut for a short distance west of Highway Bridge No. 13 where left in a bad condition by the Globe Construction Company. Reconstructed an 18-inch intake that was destroyed by frost and freshets.

Mile 20 is now 96 per cent complete.

Mile 21.—This mile lies in Cecils Slough, and the material is peat except that section between stations 1058 and 1068, where the canal prism passes through a low space of the high land. This is a tenacious clay, alternating with frequent pockets of muck and quicksand. The peat sections have been partially excavated with the cableway dredge during the year, and the clay section was excavated with wheeled and drag scrapers and the turntable dredge, a part having been done by hired labor and the balance placed under contract with Winston Brothers Company. The contract expired June 30, but owing to freshets they were granted an extension to July 31.

The quantities excavated on this mile during the year are as follows:

	Cubic yards.
With cableway dredge, hired labor	170,168
With wheeled and drag scrapers, hired labor	22,604
By contractor	20,240
Total	213,012

Seventy-three per cent of the standard section of the canal on this mile has been excavated, but indications point to the necessity of enlarging the section in places and of enlarging the section or docking in others.

Mile 22.—Eight hundred feet of this mile lies in Cecils Slough, and the material is peat. The balance of the mile lies in the saddle of the divide between the water courses of the Illinois and Green rivers. The cut varies from 14 to 38 feet in the hill section. A part of the hill section had been excavated at the beginning of the fiscal year. During the year it has been completed, a part having been done by hired labor and the remainder by contract.

By an agreement with the Chicago and Northwestern Railroad Company they put in side tracks and took away the material loaded onto cars by the contractor to fill in a long trestle on their road. This arrangement was advantageous to the railroad company, and it enabled the United States to let the excavation at a very low figure.

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The quantities excavated on this mile during the year are as follows:

	Cubic yards.
With cableway dredge, hired labor	169,690
With turntable dredge, hired labor	38,970
With teams, hired labor	503
With steam shovel, contractor	146,432
Total	355,595

More material has been excavated during the year from the peat section between stations 1108 and 1132+50 on this mile than was contained in a standard section of canal of this length because of the necessity of flattening the slopes and increasing the bottom width. Notwithstanding the increase of section this part of the canal will have to be gone over again and indications point to the necessity of docking it. It is impossible therefore to state the percentage of completion of this mile.

Other work done by hired labor on this mile during the year is as follows: Constructed temporary approaches to Highway Bridge No. 14, 3,000 cubic yards of earth, with framed trestle work between the ends of earth embankments and the abutments; put in 9 concrete intakes in the canal slopes; put in 500 feet of tile-drain under the waste banks and across right of way to take care of surface drainage.

Mile 23.—This mile is complete. Seventy-eight thousand seven hundred and seventy-nine cubic yards were excavated during the year with the turntable dredge, and 3,000 cubic yards were excavated with teams, where not accessible with dredge. The slopes were dressed and ditched and soiled where necessary. Nine concrete intakes were put in to protect the slopes from flood waters, and about 2,200 feet of tile laid under waste banks. Two hundred and sixty-eight square yards of slope paving were put in to protect the abutments of Highway Bridge No. 15.

Mile 24.—This mile is complete. The work done on this mile during the year consisted of embankment to the extent of 2,000 cubic yards necessary to raise the south bank through Devils Slough to grade in places where it had settled, and a little soiling and ditching of slopes at the east end of the mile where washouts had occurred.

Mile 25.—This mile is complete, except the filling of a gap in one bank about 30 feet long where at present a drainage ditch charges into the canal. No work has been done on this mile during the year other than a very little maintenance work such as repairs to fences, ditches, etc.

Mile 26.—This mile is complete, except a spillway at Culvert No. 8. Put in about 200 square yards of stone revetment at Highway Bridge No. 16, necessary to complete the protection revetment at this place. Regraveled the approaches of Highway Bridge No. 16. Maintained the fences.

Mile 27.—Put in about 300 square yards of stone revetment to complete the protection of the revetment curves in the embankment at Highway Bridge No. 17, regraveled the bridge approaches, and maintained the fences. This mile is complete except a flushing gate at Culvert No. 9.

Mile 28.—This mile is complete, except about 300 square yards of stone revetment necessary for the protection of the banks and bridge abutments at Highway Bridge No. 18A. No work has been done on this mile other than the maintenance of fences.

In conclusion, I desire to thank the following employees for faithful and efficient service: Junior Engineers S. L. Bayless, Joseph Wright, and C. A. Clement, Clerk C. F. Scott, and Inspector George W. Choate.

Very respectfully, your obedient servant,

JAS. C. LONG,
Assistant Engineer.

Lieut. Col. W. H. BIXBY,
Corps of Engineers.

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REPORT OF MR. C. V. BRAINARD, ASSISTANT ENGINEER.

TISKILWA, ILL., *July 6, 1905.*

COLONEL: I have the honor to submit herewith report of operations on construction of lock gates, Illinois and Mississippi Canal, for the fiscal year ending June 30, 1905.

I was assigned this work April 1; the ironwork had all been contracted for previously.

During March and April bills and specifications for lumber were prepared and proposals invited for the delivery of the lumber at various points along the line of the canal. The proposals provided for the delivery of enough lumber to build gates for three locks before the 15th of May, but up to June 30 only enough for one lock had been delivered; the remainder of the lumber is to be delivered at various times and to be completed September 15. Long-leaf yellow pine is used for the timbers, Oregon fir for the sheathing, and white oak for the miter sills. The plant necessary for the work has been assembled at Locks 3, 4, and 5. Ten carloads of iron for gates were received and distributed to Locks 1 to 21. All iron for Locks 1 to 12, inclusive, has been delivered. One carload of lumber was received.

On June 23 the framing of timber for the gates at Lock 3 was begun, and at the end of the month timbers for one lower and one upper leaf were framed, and four timbers of the lower leaf were in place.

Very respectfully, your obedient servant,

C. V. BRAINARD,
Assistant Engineer.

Lieut. Col. W. H. BIXBY,
Corps of Engineers.

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APPENDIX M M.

IMPROVEMENT OF MICHIGAN CITY HARBOR, INDIANA, AND OF RIVERS AND HARBORS ON THE EASTERN SHORE OF LAKE MICHIGAN.

REPORT OF COL. M. B. ADAMS, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1905, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Harbor at Michigan City, Indiana.
2. St. Joseph Harbor and River, Michigan.
3. Harbor at South Haven, Michigan.
4. Harbor at Saugatuck and Kalamazoo River, Michigan.
5. Harbor at Holland (Black Lake), Michigan.
6. Harbor at Grand Haven, Michigan.
7. Grand River, Michigan.
8. Muskegon Harbor, Michigan.
9. Harbors at White Lake and Pentwater, Michigan.
10. Harbor at Ludington, Michigan.
11. Harbor at Manistee, Michigan.
12. Harbor of Refuge at Portage Lake, Michigan.
13. Arcadia Harbor, Michigan.
14. Frankfort Harbor, Michigan.
15. Harbor at Charlevoix, Michigan.
16. Harbor at Petoskey, Michigan.

HARBOR LINES.

17. Grand River at Grand Rapids, Michigan.

UNITED STATES ENGINEER OFFICE,
Grand Rapids, Mich., July 17, 1905.

GENERAL: I have the honor to submit herewith the annual report of works of river and harbor improvement under my charge for the fiscal year ending June 30, 1905.

Very respectfully, your obedient servant,

M. B. ADAMS,
Colonel, Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

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M M 1.

IMPROVEMENT OF HARBOR AT MICHIGAN CITY, INDIANA.

The history of this improvement is brought to the beginning of the fiscal year in the Report of the Chief of Engineers for 1904, pages 2969–2976.

OPERATIONS DURING FISCAL YEAR ENDING JUNE 30, 1905.

Operations under the contract with Robert Millen & Co. for repairing the west entrance pier between stations 16+20 and 21+58 and the east entrance pier between stations 6+70 and 14+05 and for closing the entrance to the outer basin were continued and finally completed in November, 1904. The repaired portion of the west pier now consists of the old pile substructure; of a new wall of triple sheet piles along the front wall, outer end wall, and about 50 feet of the rear wall at the outer end, protected by new round piles and an outer wale, and strengthened by iron tie-rods passing from the front to the rear wales; of a new timber superstructure 6 feet high, and a plank walk on top. The outer 45 feet of the pier is filled with stone to the top, and in the rest of the repaired work the filling reaches to about water surface. In consequence of the reconstruction of the outer end the pier was extended 2.8 feet to station 21+60.8. The outer end of the pier is protected by a detached cluster of 13 piles. The following is a detailed statement of the work done and materials put in place after July 1: 140 linear feet of trench excavated for the removal of obstructions from the site of sheet piles; 26.2 linear feet of guide timber; 135 compound sheet piles, occupying 139.3 linear feet in the work; 314 linear feet of upper binder; 414 linear feet of lower binder; 34 round piles; 324.5 linear feet of front wale; 120 feet of rear wale; 40 tie-rods; six courses of superstructure, varying in length from 222.5 feet in the lower course to 342.5 feet in the top course; 16.4 cords stone in the outer 45 feet, and a plank walk 3 feet wide extending over the entire length of the repaired work. The present condition of the repaired part of the east entrance pier is as follows: Along the front of the old crib substructure, which partly remains in place, there is a continuous wall of triple sheet piling, protected in front by round piles and an outer wale and strengthened with iron tie-rods, and the work is completed with a timber superstructure four courses high from stations 6+70 to 10+93 and six courses high from stations 10+93 to 14+05, the front wall resting on the new round piles and the rear wall partly on the old cribwork and partly on new piles driven through the old work. The work is filled with stone to slightly above water surface, and a plank walk 3 feet wide extends over the top. Between stations 6+82 and 7+14 and between stations 13+90 and 14+50 there are openings through the work for the convenience of the United States Life-Saving Service. A detailed statement of the work done and materials secured in place under this contract after July 1 is as follows: 264 linear feet of old work cut down to grade; 508.5 linear feet of guide timber; 498 triple sheet piles extending over 513.2 linear feet of work; 516.5 linear feet of

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upper binder and 556.5 linear feet of lower binder; 86 round front piles and 5 rear piles; 503.5 linear feet of front wale; 105 linear feet of rear wale; 64 tie-rods; 6 courses of superstructure, varying in length from 478.5 linear feet in the first course to 502.5 linear feet in the fourth course, and from 119.5 linear feet the fifth course to 127.5 linear feet in the sixth course; 129.33 cords stone; 687 linear feet of plank walk. Besides, the boat slide of the life-saving station was rebuilt. The work done since July 1 to complete the structure closing the entrance to the old basin was as follows: 188.06 cords stone were put in and 463.6 linear feet of plank walk secured in place.

By dredging, under the contract with Samuel O. Dixon, begun August 1 and completed August 10, the shoal in front of the breakwater pier just outside of the west entrance pier was removed, and the channel between the piers, was widened by a cut 30 feet wide and 1,010 feet long. The dredging resulted in a depth of 18 feet for a width of 100 feet next to the breakwater pier and in a depth of 15 feet for a width of 60 feet between the piers. The depths refer to zero of gauge. The amount of material dredged measured 10,227 cubic yards, and cost 17½ cents per cubic yard.

On October 20 the care of the lights at harbor entrance, which had been maintained up to that time at the expense of the appropriations for this harbor, was assumed by the United States Light-House Establishment.

A break in the rear wall of the breakwater pier at its junction with the old east breakwater was partially repaired by day labor and material purchased in open market.

The cost of the foregoing operations was:

Repair of piers and closing entrance to outer basin	$18,521.38
Repairing break in breakwater pier	234.74
Dredging	1,789.72

A contract for such dredging as may be found necessary to restore navigable conditions was entered into April 29, 1905, with the Chicago and Great Lakes Dredge and Dock Company.

CONDITION OF WORK JUNE 30, 1905.

The west entrance pier, as built by the Government, has a total length of 2,160.8 feet, consisting of 1,360.8 feet of pile work and 800 feet of crib work. The inner section of 785 feet was formerly occupied by private parties, but at present no such use is made of it. The inner end for a length of 228 feet is destroyed; the next 386 feet has been rebuilt during recent years by the riparian owners. The outer part of the west pier for a length of 540.8 feet has been repaired and sheet piled. The remainder, 1,006 feet in length, is in need of extensive repairs above water and sheet piling to make it sand tight. The east entrance pier, together with the structure across the entrance of the old basin, has a length of 1,869.5 feet, of which the inner 670 feet is in front of private property and totally wrecked. The section from station 6+70 to station 14+05 has been substantially repaired and sheet piled. A city ordinance requires riparian owners to maintain docks or revetments along their water fronts in the inner harbor, but the existing revetments are in bad condition in many places. The breakwater pier, connecting with the structure across the entrance to

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the outer basin, has a total length of 1,136 feet. It is in good condition, except in the first 30 feet, which formed the head of the now abandoned old east breakwater. This portion has given signs of deterioration, and may need repairs in the near future.

By the act of March 3, 1905, the project has been modified by providing for the construction of a turning basin in the inner harbor. This modification involves the removal of the south 450 feet of the east entrance pier and of the revetment on the north side of the inner harbor to the Franklin Street Bridge, and the construction of new revetments, of which the part along the south boundary of the United States light-house reservation will have to be built by the Government and the remainder by the riparian owners or by the local authorities.

Soundings made May 23 to June 1 showed the following available depths: In the outer entrance, 20 to 32 feet; at the entrance to the inner harbor, 18 feet for a width of 120 feet next to the east pier; thence to the inner end of the pier, 16 feet in the channel of best water; thence to Sixth Street Bridge, 15 feet, except about 300 feet below the angle above Franklin Street Bridge, where the available depth was 14.5 feet; from the Sixth Street Bridge to the first angle above, 14.5 feet; thence to the second angle, 12 feet; and at the lower end of the upper basin, 7 feet. The depths refer to the zero of harbor gauge.

The Michigan City and Northern Indiana Gas Company placed a gas pipe under the channel in the vicinity of Fifth street, and the Central Union Telephone Company a telephone cable near the Sixth Street Bridge, both being so laid as to offer no obstruction to navigation.

WORK PROPOSED FOR FISCAL YEAR ENDING JUNE 30, 1906.

By the river and harbor act of March 3, 1905, there was appropriated for continuing improvement and for maintenance $45,000, with the provision that, in the discretion of the Secretary of War, an amount not exceeding $25,000 may be used for the construction of a turning basin in the inner harbor. Steps are now being taken toward the transference of the land required by the United States for the construction of the turning basin, and as soon as this object has been satisfactorily secured the work will be begun under a contract to be entered into for the purpose. Of the balance then remaining available it is proposed to reserve $4,100 as part payment for an inspection steamer, $10,000 for dredging in the channels two seasons, and to reserve the remainder for the payment of office expenses and contingencies and for such dredging or repairs as may become necessary.

ESTIMATE OF FUNDS FOR FISCAL YEAR ENDING JUNE 30, 1907.

To complete the approved project there remains 200 linear feet still to be added to the detached breakwater. The estimated cost of this work is $30,000. The outer 540.8 feet of the west entrance pier having been repaired, there remains an additional length of 1,006 feet, which must be maintained by the Government and which is in need of sheet piling and new superstructure. This, estimated at $27 50

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per linear foot, will cost $27,665. For the customary annual dredging for the maintenance of navigation there is required $5,000, and to provide for the repairs of possible damage to the extensive works and for refilling, an estimate of $5,000 is made. The sum of these items is $67,665.

Total amount appropriated and allotted to June 30, 1905			$1,584,138.92
Miscellaneous receipts			4,130.00
			1,588,268.92
Less amount carried to surplus fund			5.15
			1,588,263.77
Total amount expended on previous projects from July 4, 1836, to June 30, 1902:			
For construction	$1,009,507.04		
For maintenance	187,084.80		
		$1,196,591.84	
Total amount expended to June 30, 1905, on existing project adopted March 3, 1899, and amended March 3, 1905:			
For construction	294,988.19		
For maintenance	43,499.35		
		338,487.54	
			1,535,079.38
Balance			53,184.39
Estimated cost of project, 1899, amended 1905			337,150.00

Money statement.

July 1, 1904, balance unexpended			$61,869.78
Amount appropriated by river and harbor act approved March 3, 1905			45,000.00
			106,869.78
June 30, 1905, amount expended during fiscal year:			
For works of improvement		$22,173.03	
For maintenance of improvement		[a]31,512.36	
			53,685.39
July 1, 1905, balance unexpended			53,184.39
July 1, 1905, outstanding liabilities			147.26
July 1, 1905, balance available			53,037.13
July 1, 1905, amount covered by uncompleted contracts			4,500.00
Amount (estimated) required for completion of existing project			30,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:			
For works of improvement		$30,000.00	
For maintenance of improvement		37,665.00	
			67,665.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

[a] $943.75 on account dredge.

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APPROPRIATIONS.

Date.	Outer harbor.	Inner harbor.	Total.
July 4, 1836			$20,000.00
March 3, 1837			30,000.00
July 7, 1838			60,733.59
June 11, 1844			25,000.00
August 30, 1852[a]			20,000.00
March 2, 1855 (claim of J. R. Bowes)			470.33
June 23, 1866			75,000.00
July 25, 1868 (allotment)			25,000.00
April 10, 1869 (allotment)			31,185.00
July 11, 1870	$25,000.00		25,000.00
March 3, 1871	15,000.00		15,000.00
June 10, 1872	50,000.00		50,000.00
March 3, 1873	50,000.00		50,000.00
June 23, 1874	50,000.00		50,000.00
March 3, 1885	50,000.00		50,000.00
August 14, 1876	35,000.00		35,000.00
June 18, 1878	50,000.00	$25,000.00	75,000.00
1878 (allotment)	2,500.00		2,500.00
March 3, 1879	40,000.00		40,000.00
June 14, 1880	40,000.00	15,000.00	55,000.00
March 3, 1881	20,000.00	25,000.00	45,000.00
August 2, 1882	60,000.00	20,000.00	80,000.00
July 5, 1884	40,000.00	10,000.00	50,000.00
August 5, 1886	54,375.00	1,875.00	56,250.00
August 11, 1888	90,000.00	5,000.00	95,000.00
September 19, 1890	50,000.00	7,500.00	57,500.00
July 13, 1892	30,000.00	15,000.00	45,000.00
August 18, 1894	20,000.00	10,000.00	30,000.00
June 3, 1896	70,000.00	10,000.00	80,000.00
March 3, 1899		7,500.00	7,500.00
June 6, 1900	195,000.00		195,000.00
June 13, 1902			63,000.00
March 3, 1905			45,000.00
Miscellaneous receipts			4,130.00
Total	1,066,875.00	151,875.00	1,588,268.92

[a] Amount carried to surplus fund, $5.15.

ABSTRACT OF CONTRACTS IN FORCE.

Repair of piers and closing entrance to outer basin.

Contractor: Robert Millen & Co.
Date of contract: February 27, 1903.
Date of approval: March 21, 1903.
Date of beginning: April 15, 1903.
Date of expiration: January 1, 1904. (Time limit waived.)
Rates: Cutting down and removing old work, $3 per linear foot; white-oak piles, 33 cents per linear foot; white-oak timber, $40 per M feet B. M.; white-pine, long-leaf yellow-pine, or Douglas-fir timber, $33 per M feet B. M.; white-pine, long-leaf yellow-pine, or Douglas-fir planks for sheet piles, $39 per M feet B. M.; white pine or long-leaf yellow pine for decking, $30 per M feet B. M.; driftbolts, 2½ cents per pound; screw bolts and tie-rods, 3 cents per pound; carriage bolts and spikes, 4 cents per pound; stone, $6.50 per cord.

Dredging.

Contractor: Samuel O. Dixon.
Dated: March 25, 1904.
Approved: April 15, 1904.
Date of beginning: May 3, 1904.
Date of expiration: September 17. (Time limit waived.)
Rate: 17½ cents per cubic yard.

Contractor: Chicago and Great Lakes Dredge and Dock Company.
Dated: April 29, 1905.
Approved: May 9, 1905.
Date of beginning: May 27, 1905.
Date of expiration: September 12, 1905.
Rate: 17½ cents per cubic yard.

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COMMERCIAL STATISTICS FOR MICHIGAN CITY HARBOR, INDIANA, CALENDAR YEAR ENDING DECEMBER 31, 1904.

[Compiled from statement furnished by deputy collector of customs at Michigan City, Ind.]

Character of vessels.	Number.	Tonnage.
Steam, entered and cleared	812	286,414
Sail, entered and cleared	41	6,591
Total	853	293,005

Maximum draft, 15.3 feet in inner harbor to lower basin and 11.1 feet above.

Receipts by vessels.

Articles received.	Tons.
Lath	1,154
Lumber	49,652
Salt	12,068
Shingles	424
Wood	4,590
Total	67,888

NOTE.—No record whatever is kept of the commerce between Michigan City and Chicago, South Chicago, and other ports in this district. There is a twice-daily boat line to Chicago doing an immense passenger traffic and large freight business.

	Tons.
Total freight carried in 1903	117,329
Total freight carried in 1904	67,888
Decrease	49,441

M M 2.

IMPROVEMENT OF ST. JOSEPH HARBOR AND RIVER, MICHIGAN.

The history of these works to the beginning of the year is found in the Report of the Chief of Engineers for 1904, pages 2976–2978.

(A) ST. JOSEPH HARBOR.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1905.

The dredging operations under the contract with Samuel O. Dixon for the restoration of navigable widths and depths, commenced on June 20, 1904, were completed July 31, and resulted in restoring a channel 17 feet deep at the stage of zero of gauge and about 200 feet wide next to the north pier between the projecting part of the piers, 17 feet deep and 90 feet wide in the interior harbor to the mouth of the Benton Harbor Canal, and in the Benton Harbor Canal a depth of 15 feet with a width of 90 feet from the mouth to the Paw Paw River, and of 60 feet thence to Benton Harbor. The dredged quantity from July 1 to 31 was 35,170 cubic yards, and the price per cubic yard 17½ cents, making a total of $6,154.75.

CONDITION OF WORK JUNE 30, 1905.

The total length of the north pier and revetment is 2,854 feet, consisting of 2,183.5 feet cribwork and 670.5 feet pile work. At the

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east end a pile wing 165 feet long connects with the dock of the United States light-house depot. The south pier is about 2,623 feet long and consists of 1,803 feet of cribwork and 820 feet of pile work. All these structures are in excellent condition, except the wing at the east end of the north pier, the filling of which is not in good condition.

Soundings made May 16–20 showed the following available depths, referred to the level of zero of gauge: Outside of the entrance, 19.1 feet on line of north pier; 16 feet 200 feet south of that line, and 19.5 feet on line of south pier. Between the piers, at the outer end, 18 feet for a width of 130 feet next to the north pier, and 16.1 feet in the middle of channel; thence to the angle, 18 feet for a width of 100 feet in the north half of channel, and the same width and depth next to the south pier from the angle to the railroad bridge; at the upper end of the bridge, 17.2 feet; thence to the mouth of the Benton Harbor Canal, 18 feet for a width of 60 feet, and in the Benton Harbor Canal, 18 feet for a width of 40 feet throughout, except a length of about 400 feet near the upper end, where the depth in center of channel was 16.6 feet. The stage of the lake at the time of sounding varied from —0.2 to —0.6 feet.

WORK PROPOSED FOR FISCAL YEAR ENDING JUNE 30, 1906.

The act of March 3, 1905, appropriated $15,000 for continuing improvement and for maintenance. The balance remaining on hand from previous appropriations is $8,620.65, making the total amount available $23,620.65. Of this amount $1,500 is reserved as part payment of an inspection steamer, $20,000 is to be expended for dredging, the work as far as possible to be done by the U. S. dredge *General Gillespie*, and the remainder is to be reserved for contingencies and incidental repairs.

ESTIMATE OF FUNDS FOR FISCAL YEAR ENDING JUNE 30, 1907.

All new construction work under the authorized project has been completed, and the existing works on the entrance channel are in serviceable condition. The channels are subject to deterioration caused by the accretions of sand brought down by the St. Joseph and Paw Paw rivers when in flood, and as this is a matter of annual recurrence it follows that dredging for the restoration of the required widths and depths of channel may be expected to be necessary every year. The amount estimated required for this purpose and for incidental repairs for one year is $10,000.

(B) ST. JOSEPH RIVER.

OPERATIONS DURING FISCAL YEAR ENDING JUNE 30, 1905.

Operations on St. Joseph River were executed by a small force, hired by day labor, during the months of July, August, and September, 1904. A number of snags were removed from the channel and trees that interfered with navigation from the banks between Shaker Farm and Kings Landing; also one wing dam was built at Shaker Farm and two near Twin Springs. The cost of these operations was $449.51.

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Under date of March 23, 1905, the Secretary of War approved plans and authorized the construction of a bridge by the county of Berrien, across the river about 2 miles above its mouth, to replace what was known as the old Napier bridge.

On June 15, 1905, the Secretary of War authorized the authorities of Berrien County to renew the viaduct over the Morrison channel and Michigan Central Railroad in the city of St. Joseph.

WORK PROPOSED FOR FISCAL YEAR ENDING JUNE 30, 1906.

No provision was made for this work in the act of March 3, 1905, and the balance remaining available from previous appropriations is $360.49. With this it is proposed to do such work as may be needed to restore the 3-foot channel of the project.

ESTIMATE OF FUNDS FOR FISCAL YEAR ENDING JUNE 30, 1907.

The customary estimate for this work is $750.

ST. JOSEPH HARBOR.

Total amount appropriated and allotted to June 30, 1905			$873,313.00
Miscellaneous receipts			1,027.15
			874,340.15
Less amount carried to surplus fund			.80
			874,339.35
Total amount expended July 4, 1836, to March 3, 1899:			
For construction	$336,479.50		
For maintenance	166,633.73		
		$503,113.23	
Total amount expended on project approved March 3, 1899:			
For construction	$303,078.41		
For maintenance	44,527.06		
		347,605.47	
			850,718.70
Balance			23,620.65

Money statement.

July 1, 1904, balance unexpended			[a] $33,638.77
Amount appropriated by river and harbor act approved March 3, 1905			15,000.00
			48,638.77
June 30, 1905, amount expended during fiscal year:			
For works of improvement		[b] $15,350.37	
For maintenance of improvement		[c] 9,667.75	
			25,018.12
July 1, 1905, balance unexpended			23,620.65
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905			10,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.			

[a] Exclusive of $2,851.54 expended for dredge to June 30, 1904.
[b] Includes $6,497.30 for dredge.
[c] Includes $651.16 for dredge.

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ST. JOSEPH RIVER.

Total amount appropriated and allotted to June 30, 1905		$6,250.00
Total amount expended 1888 to June 30, 1905:		
For construction	$4,555.49	
For maintenance	1,394.02	
		5,949.51
Balance		300.49

Money statement.

July 1, 1904, balance unexpended	$750.00
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	449.51
July 1, 1905, balance unexpended	300.49
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	750.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

APPROPRIATIONS.

St. Joseph Harbor and River, Michigan.

July 4, 1836		$20,000.00	
March 3, 1837		15,000.00	
July 7, 1838		51,113.00	
March 3, 1843		25,000.00	
June 11, 1844		20,000.00	
August 30, 1852		10,000.00	
June 28, 1864 (allotment)		15,000.00	
June 23, 1866		6,000.00	
March 2, 1867		23,000.00	
Allotted from harbors on Northwestern Lakes, 1867	$7,500.00		
Transferred in 1870 to Grand Haven Harbor	500.00		
		7,000.00	
July 11, 1870		15,000.00	
March 3, 1871		10,000.00	
June 10, 1872		3,000.00	
June 23, 1874		2,000.00	
March 3, 1875		35,000.00	
August 14, 1876		12,000.00	
June 18, 1878		12,000.00	
March 3, 1879		$6,000.00	
June 14, 1880		8,000.00	
March 3, 1881		10,000.00	
August 2, 1882		12,000.00	
July 5, 1884		15,000.00	
August 5, 1886		10,000.00	
August 11, 1888		12,000.00	
September 19, 1890		20,000.00	
July 13, 1892		59,000.00	
August 18, 1894		30,000.00	
June 3, 1896		30,000.00	
March 3, 1899		50,000.00	
June 6, 1900		253,950.00	
March 3, 1901		38,000.00	
June 13, 1902		23,250.00	
March 3, 1905		15,000.00	
Miscellaneous receipts		1,027.15	
Total		874,340.15	
Amount carried to surplus fund, 1856		.80	
Balance		874,339.35	

St. Joseph River, Michigan.

August 11, 1888		$2,500.00	
September 19, 1890		1,000.00	
July 13, 1892 (allotment)		1,000.00	
August 18, 1894		500.00	
June 3, 1896		$500.00	
June 13, 1902		750.00	
Total		6,250.00	

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ABSTRACT OF CONTRACTS IN FORCE.

Dredging.

Contractor: Samuel O. Dixon.
Date of contract: March 25, 1904.
Date of approval: April 15, 1904.
Dat of beginning: May 3, 1904.
Date of expiration: September 17, 1904. (Time limit waived.)
Rate: 17½ cents per cubic yard.

COMMERCIAL STATISTICS.

St. Joseph Harbor, Michigan, calendar year ending December 31, 1904.

[Compiled from statements furnished by the duputy collectors of customs at St. Joseph and Benton Harbor, Mich.]

Character of vessels.	Number.	Tonnage.
Steam, entered and cleared	1,196	546,705
Sail, entered and cleared	43	5,523
Total	1,239	552,228

Maximum draft, 16 feet.

Receipts and shipments by vessel, 1904.

Articles received.	Tons.	Articles shipped.	Tons.
Barrels, empty	11	Asphalt	175
Bran	25	Baskets, empty	2
Coal	2,690	Flour	135
Flour	160	Fruit	28,080
Horses	10	Lumber	3,587
Lath	90	Paper	375
Lumber	4,915	Vinegar	55
Posts	4,517	Merchandise, miscellaneous	17,799
Salt	572		
Shingles	2,093		
Stone	7,200		
Merchandise, miscellaneous	24,545		
Total	46,828	Total	50,208

	Tons.
Total freight carried in 1903	127,872
Total freight carried in 1904	97,036
Decrease	30,836

St. Joseph River, Michigan, calendar year ending December 31, 1904.

[Compiled from statement furnished by Mr. W. H. Hull, St. Joseph, Mich.]

The steamers *May Graham*, *Willow*, and *Tourist* carried 24,703 passengers and 3,024 tons freight (principally fruit and lumber), as compared with 33,500 passengers and 3,254 tons freight carried in 1903. The boats have a maximum draft of about 3 feet.

M M 3.

IMPROVEMENT OF SOUTH HAVEN HARBOR, MICHIGAN.

The history of this work to the beginning of the year is found in the Report of the Chief of Engineers for 1904, pages 2981–2982.

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OPERATIONS DURING FISCAL YEAR ENDING JUNE 30, 1905.

Soundings made April 14–17 showed the following available depths: In front of the entrance, 17 feet on the shoalest point 50 feet north of line of south pier and 300 feet out from end of piers; on line of north pier, 19.6 feet, and on the line of south pier, 18.1 feet. Between the piers there was not less than 17.1 feet at the outer end, and there existed a narrow channel inside, with 15.2 feet available. In the river above the piers the somewhat irregular channel of best water afforded 15.1 feet, but two small lumps with only 14.1 feet existed in about mid-channel at points respectively 400 feet and 700 feet above inner ends of piers. The depths refer to the level of zero of gauge. The stage of the lake at the time of sounding was —0.5 to —0.8 foot.

Under the contract with the Chicago and Great Lakes Dredge and Dock Company, dated April 29, dredging was begun May 25 to improve the channel, and by June 21, when the work was completed, there was 16 feet between the piers and 15 feet in the river for a width of 60 feet. The dredged quantity measured 22,148 cubic yards, price per yard, 17¼ cents, making the cost $3,820.55.

CONDITION OF WORK JUNE 30, 1905.

This is as reported in the Report of the Chief of Engineers for 1901, page 3085, except for the additional deterioration due to the lapse of four years.

The condition of the navigable channel is described under the head of "Operations."

WORK PROPOSED FOR FISCAL YEAR ENDING JUNE 30, 1906.

The river and harbor act of March 3, 1905, appropriated $50,000 for this improvement, to be expended in accordance with the report sumbitted in House Document No. 119, Fifty-eighth Congress, second session, provided that no part of such amount shall be used, except for maintenance of existing channels, until proper dock lines shall have been established and suitable bulkheads shall have been built along these lines by the city of South Haven or by riparian owners, and the property lying on the channel side of these dock lines shall have been deeded to the United States, free of cost, all pursuant to the plan recommended in said House document.

The project, as modified by the above act, provides for a 16-foot depth of channel to be created by dredging; for 1,600 linear feet of cribwork to be placed in extension of the two piers, and for repairs of 1,778 linear feet of old pier, and for the removal of 60 linear feet of old revetment at the inner end of the north pier.

Until the requirements of the law regarding dock lines and bulkheads have been complied with by the interested parties, construction work under the modified project is prevented, and after providing for the necessary maintenance the remainder of the available funds will be reserved until that time. The works of maintenance will consist of dredging, requiring the sum of $8,000, to be done

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either by contract or by Government plant, and of incidental repairs to cost not exceeding $5,000, the work to be done by contract or day labor, as may be decided most economical and advantageous to the United States.

ESTIMATE OF FUNDS FOR FISCAL YEAR ENDING JUNE 30, 1907.

As stated, construction work under the modified project is prevented until the requirements of the law with reference to dock lines and bulkheads are complied with; but there is no reason to assume that this compliance will be delayed indefinitely, and it appears reasonable, therefore, to provide in this estimate for at least that part of the project providing for the dredging and the repairs of the piers. This will require, in addition to the funds remaining available for this purpose, the sum of $65,000.

Total amount appropriated and allotted to June 30, 1905		$367,300.00
Miscellaneous receipts		2,137.47
		369,437.47
Total amount expended from March, 1867, to March 3, 1905:		
For construction	$187,232.83	
For maintenance	131,239.42	
	$318,472.25	
Total amount expended March 3 to June 30, 1905, for maintenance	4,715.35	
		323,187.60
Balance		46,249.87
Estimated cost of work, 1866, amended in 1869, 1872, 1892, and 1898		297,000.00
Estimated cost project adopted March 3, 1905		279,370.00

Money statement.

July 1, 1904, balance unexpended	$3,669.65
Amount appropriated by river and harbor act approved March 3, 1905	50,000.00
	53,669.65
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	[a] 7,419.78
July 1, 1905, balance unexpended	46,249.87
July 1, 1905, outstanding liabilities	126.26
July 1, 1905, balance available	46,123.61
July 1, 1905, amount covered by uncompleted contracts	382.05
Amount (estimated) required for completion of existing project	247,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	65,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

[a] Includes $943.74 for dredge.

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APPROPRIATIONS.

March 2, 1867	$43,000.00	August 5, 1886	$5,000.00
July 11, 1870	10,000.00	August 11, 1888	10,000.00
March 3, 1871	15,000.00	September 19, 1890	15,000.00
June 10, 1872	12,000.00	July 13, 1892	10,000.00
March 3, 1873	20,000.00	August 18, 1894	20,000.00
June 23, 1874	10,000.00	June 3, 1896	15,000.00
March 3, 1875	10,000.00	March 3, 1899	45,000.00
August 14, 1876	10,000.00	June 6, 1900 (allotments)	3,300.00
June 18, 1878	12,000.00	June 13, 1902	12,000.00
March 3, 1879	7,500.00	June 13, 1902 (allotment)	5,000.00
June 14, 1880	5,000.00	March 3, 1905	50,000.00
March 3, 1881	5,000.00	Miscellaneous receipts	2,137.47
August 2, 1882	10,000.00		
July 5, 1884	7,500.00	Total	369,437.47

ABSTRACT OF CONTRACTS IN FORCE.

Dredging.

Contractor: Samuel O. Dixon.
Date of contract: March 25, 1904.
Date of approval: April 15, 1904.
Date of beginning: May 3, 1904.
Date of expiration: September 17, 1904; time limit waived.
Rate: 17½ cents per cubic yard.

Contractors: Chicago and Great Lakes Dredge and Dock Company.
Dated: April 29, 1905.
Approved: May 9, 1905.
Date of beginning: May 27, 1905.
Date of expiration: September 12, 1905.
Rate: 17½ cents per cubic yard.

COMMERCIAL STATISTICS FOR SOUTH HAVEN HARBOR, MICHIGAN, CALENDAR YEAR ENDING DECEMBER 31, 1904.

[Compiled from statement furnished by the deputy collector of customs at South Haven, Mich.]

Character of vessels.	Number	Tonnage.
Steam, entered and cleared	1,036	756,955
Sail, entered and cleared	87	2,017
Total	1,123	758,972

Maximum draft, 13.6 feet.

Receipts and shipments by vessels, 1904.

Articles received.	Tons.	Articles shipped.	Tons.
Cedar posts	161	Fruit	37,838
Lumber, shingles, etc.	128,211	Unclassed freight	17,754
Unclassed freight	19,840		
Total	148,212	Total	55,592

	Tons.
Total freight carried in 1903	76,646
Total freight carried in 1904	198,804
Increase	122,158

Passengers carried during season of 1904, 205,981.

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M M 4.

IMPROVEMENT OF HARBOR AT SAUGATUCK AND KALAMAZOO RIVER, MICHIGAN.

The history of these works is brought to the beginning of the fiscal year in the Report of the Chief of Engineers for 1904, pages 2984–2986.

OPERATIONS DURING FISCAL YEAR ENDING JUNE 30, 1905.

The dredging at the old entrance in progress at the beginning of the fiscal year under the contract with Samuel O. Dixon was completed on August 3, and resulted in providing a channel 90 feet wide and 12 feet deep at the stage of zero of gauge across the outer bar and 30 feet wide and 10 feet deep through the shoal reaches inside. The quantity of sand removed since July 1 was 25,784 cubic yards, making a total of 49,000 yards since the beginning of operations in May, 1904. The price per cubic yard was 17½ cents per yard. Cost of work done since July 1, $4,512.20.

As usual the channel was found to be again obstructed in the spring of 1905, and soundings made May 3–5 showed the following available depths, referred to zero of gauge: Outside, on the line of the south pier, 7.1 feet; between the piers on a course 40 feet from and parallel to the south pier, 11.6 feet at outer end of south pier, diminishing to 10.3 feet at a point 2,000 feet farther up; on the first shoal above the bend, 10 feet in a narrow channel, and on the second shoal, 8.6 feet. The stage of the lake at the time of sounding was —0.6 to —0.7 foot. Dredging, therefore, became necessary again for reopening the channel, and work under the contract with the Chicago and Great Lakes Dredge and Dock Company, dated April 29, 1905, was begun June 17. At the end of the year 1,025 linear feet of one cut and 425 linear feet of an adjacent cut, each 30 feet wide and 14 feet deep below zero of gauge, had been completed through the shoal at and outside of the entrance. The dredged material measured 14,529 cubic yards; price per cubic yard, 17¼ cents; making the cost $2,506.25.

The work begun in April, 1904, on the construction of the piers for the proposed new channel from Kalamazoo River to Lake Michigan was continued by contractors Burk, Smith & Nelson. Operations continued through the season until the end of November, when they were interrupted for the winter, and they were resumed April 19, the time limit having been waived in the meanwhile. The following is a detailed description of the work done during the fiscal year:

North pier.—The site for the end crib of the pier was dredged to the required depth, the 64 foundation piles were driven and sawed off at the proper level, and the crib was sunk in its place July 29. The crib is 100 feet long, 24 feet wide, and 16½ feet high, with the top at zero of gauge. Thirty-seven additional round piles were driven in the front row, completing the row, and 395 piles in the rear row extending from the crib for a distance of 1,159 feet toward shore. The front wale and upper guide were secured in place for the whole distance of 1,202 linear feet. There were 1,150 triple sheet piles driven between the crib, station 1, and station 12+55.6, a distance of 1,155.6 feet, and the binding timber was secured from station 1 to station

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12+18.5. The rear wale was put in place from station 1 to station 12+05, and 39 tie-rods were put in between station 1 and station 8+94.5. The six courses of superstructure were completed over the crib, the 10 guard piles and the 3 horizontal guard timbers at the outer end were put in place, as also the 2 mooring posts, and the crib was filled with stone and decked over. The superstructure over the pile work was built for the following lengths, commencing at the cribs: Course 1 for 1,130.5 feet, course 2 for 1,085.5 feet, course 3 for 1,079.5 feet, course 4 for 1,070.5 feet, and course 5 for 600 feet. There were 394.3 cords stone placed in this work between station 1 and station 7+68.5. During the storm of September 2 the 23 sheet piles between station 1 and station 1+23.1, together with the attached guide, binder, front piles, and wale, were washed out, and had to be replaced, which was done during the succeeding month. Part of the plank walk 2 feet wide, and extending from the crib for a distance of 1,175 feet, was rendered insecure by the sea entering the pier through the open rear wall, and was removed, to be replaced when the remainder of the work is completed. The storm of December 27 was quite disastrous to the partly completed pier. About 200 linear feet of the front wall next to the crib was undermined, the sand having been washed away to a depth of 20 feet and more, the sheet piles and most of the round front piles were washed out, and the front wall of the superstructure was raised 5 feet above its original level in the worst place, rendering it unserviceable. This part of the pier must be rebuilt by the contractors before the final acceptance of the work.

South pier.—The site of the end crib was dredged, and the 64 foundation piles were driven and sawed off at grade. The crib was sunk in its place August 23. The crib has the same dimensions as that in the north pier. The row of front piles in the pile pier was completed from the crib, station 1, to station 11+51 by driving 276 piles, and the rear row from station 1 to station 11+19 by driving 340 piles. The front wale was put in place for a distance of 1,052 feet, and the guide timber for a distance of 1,040.5 feet. There were 831 triple-sheet piles driven between station 3+00.1 and 11+40.5, and those from station 3+00.5 to station 10+02.5 were secured by the binding timber. The wale on the rear piles was secured for a distance of 1,015 feet. The superstructure over the crib was built for distances varying from 97 feet in the first course to 43 feet in the sixth course, commencing at the outer end, and the 10 guard piles and the first guard timber were put in place. The first course of superstructure on the pile work was built between station 6+54.5 and station 7+08.5. The crib was made practically full of stone, and 290.5 cords stone were distributed in the pile work between station 3+20 and station 8+72.

The cost of the operations under the foregoing contract was $48,597.55.

Under date of June 16 a contract was entered into with the Great Lakes Dredge and Dock Company for excavating the new channel through the neck of land between Kalamazoo River and Lake Michigan.

The following cases of accident to vessels using the old channel occurred during the fiscal year:

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On July 23 the steamer *Post Boy*, plying between Holland and Saugatuck, ran upon a submerged pile abreast of and about 110 feet from the south revetment at station 35, and received two holes below the water line. Upon reaching Saugatuck she sank at her dock, but was subsequently raised and repaired.

On August 24 the steamer *Saugatuck*, while on her regular trip from Saugatuck to Chicago, went on the bar outside of the entrance, and was not released until the following day, leaking badly. The steamer was in charge of a new master and pilot, who were not acquainted with the channel. The point where the boat grounded was 50 feet north of the recently dredged channel, in which the available depth at that time was 12 feet.

On June 5 the schooner *L. B. Forester* ran upon a submerged pile on the north side of the channel opposite the upper end of the south revetment and sank, but was subsequently removed by the crew. She at no time interfered with navigation.

In all these cases the accidents were caused by the vessels not following the proper channel.

CONDITION OF WORK JUNE 30, 1905.

This, as far as it relates to the old entrance, remains as described in the Report of the Chief of Engineers for 1900, page 3888, with the added deterioration due to the lapse of five years. The condition of the work at the new entrance and of the channel at the old entrance is described under the head of operations.

WORK PROPOSED FOR FISCAL YEAR ENDING JUNE 30, 1906.

The act of March 3, 1905, appropriated $75,000 for continuing improvement and for maintenance. Of this amount $15,000 has been set aside for dredging to maintain the customary depth at the old entrance during the seasons of 1905 and 1906. The dredging for the season of 1905 is now in progress and will be completed during the month of July. The work under contract with Burk, Smith & Nelson for the construction of the piers for the new entrance will be completed. The damage to the outer 200 feet of the pile work in the north pier indicates the necessity of substituting sheet piles 26 feet long for the 23-foot lengths required by the specifications for the outer 200 feet of pile work in both piers, and recommendation has been made for the conclusion of a supplementary contract for this purpose. The work of excavating the new channel from Kalamazoo River to Lake Michigan will be begun by the Great Lakes Dredge and Dock Company, contractors, early in July, and should be completed during the fiscal year. The balance of the available funds will be reserved for emergency work, if any should arise in connection with the construction of the new channel, or will be added to future appropriations for continuing or completing this work.

ESTIMATE OF FUNDS FOR FISCAL YEAR ENDING JUNE 30, 1907.

As the proposed new entrance to be created under the Kalamazoo River project can not possibly become available before the end of

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the calendar year 1907, it will be necessary to maintain the existing entrance in serviceable condition until that time. Past experience proves that not less than $7,500 is required each year for the temporary restoration of an approximately satisfactory channel, and the estimate, therefore, is that amount for this purpose.

The estimate for the Kalamazoo River project was $250,000. Of this, $175,000 has been made available by past appropriations, leaving $75,000 still to be appropriated. As stated above, the funds now available for this work are to be applied to the construction of the projecting piers, and to the partial excavation of the channel. There will then remain the construction of the revetments for the cut, the final opening of the channel by the removal of the barrier to be left across the cut until that time, and such additional dredging as may be found necessary, and the dam across the old channel to direct the river into the new cut; and as the new entrance can not become available for the use of navigation before the completion of the entire project, the estimate presented herewith calls for the entire amount remaining to be apropriated, viz, $75,000.

The total estimate is therefore as follows:

For maintenance of old entrance	$7,500
For completion of Kalamazoo River project	75,000
Total	82,500

SAUGATUCK HARBOR.

Total amount appropriated and allotted to June 30, 1905		$217,239.00
Total amount expended from July, 1868, to June 30, 1905:		
For construction	$90,231.99	
For maintenance	111,617.27	
		201,849.26
Balance		15,389.74
Estimated cost of existing project 1867, modified 1869, 1870, 1875, 1882, and 1892		175,699.46

Money statement.

July 1, 1904, balance unexpended	$8,984.88
Amount appropriated by river and harbor act approved March 3, 1905	15,000.00
	23,984.88
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	8,595.14
July 1, 1905, balance unexpended	15,389.74
July 1, 1905, outstanding liabilities	115.47
July 1, 1905, balance available	15,274.27
July 1, 1905, amount covered by uncompleted contracts	6,800.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	7,500.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

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KALAMAZOO RIVER.

Total amount appropriated and allotted to June 30, 1905	$175,000.00
Total amount expended to June 30, 1905, for construction	67,672.40
Balance	107,327.60
Estimated cost of existing project approved June 3, 1896, as amended May 31, 1900	250,000.00

Money statement.

July 1, 1904, balance unexpended	[a] $94,048.05
Amount appropriated by river and harbor act approved March 3, 1905	60,000.00
	154,048.05
June 30, 1905, amount expended during fiscal year, for works of improvement	[b] 46,720.45
July 1, 1905, balance unexpended	107,327.60
July 1, 1905, outstanding liabilities	39.20
July 1, balance available	107,288.40
July 1, 1905, amount covered by uncompleted contracts	78,324.09
Amount (estimated) required for completion of existing project	75,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	75,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

APPROPRIATIONS FOR IMPROVING SAUGATUCK HARBOR AND KALAMAZOO RIVER, MICHIGAN.

Date.	Saugatuck Harbor.	Kalamazoo River.	Total.
July 25, 1868 (allotment)	$23,900		$23,900
April 10, 1869 (allotment)	6,099		6,099
July 11, 1870	10,000		10,000
March 3, 1871	10,000		10,000
June 10, 1872	15,000		15,000
March 3, 1873	10,000		10,000
June 23, 1874	10,000		10,000
March 3, 1875	10,000		10,000
August 14, 1876	3,000		3,000
June 18, 1878	2,500		2,500
March 3, 1879	5,000		5,000
June 14, 1880	5,000		5,000
March 3, 1881	5,000		5,000
August 2, 1882	8,000		8,000
July 5, 1884	4,000		4,000
August 5, 1886	8,000		8,000
August 11, 1888	5,000		5,000
July 13, 1892	5,000		5,000
August 18, 1894	12,000		12,000
June 3, 1896	10,000	$5,000	15,000
March 3, 1899	7,000	10,000	17,000
June 6, 1900 (allotments)	7,500		7,500
June 13, 1902	15,000		15,000
June 13, 1902 (allotment)	5,300		5,300
March 3, 1903		100,000	100,000
March 3, 1905	15,000	60,000	75,000
Total	217,299	175,000	392,299

[a] Exclusive of $19,200 expended for dredge to June 30, 1904.
[b] Includes $4,800 for dredge.

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ABSTRACT OF CONTRACTS IN FORCE.

Pier construction.

Contractor: Burk, Smith & Nelson.
Date of contract: July 15, 1903.
Date of approval: August 31, 1903.
Date of beginning: Not later than April 15, 1904.
Date of expiration: December 31, 1904; time limit waived.
Rates: Dredging for crib foundations, 75 cents per cubic yard; foundation piles, 50 cents per linear foot; white-oak piles, 32 cents per linear foot; white-oak timber, $50 per M; white-pine, long-leaf yellow-pine, or Douglas-fir timber, $33 per M; hemlock or Norway pine timber, $24 per M; white-pine, long-leaf yellow-pine, or Douglas-fir planks for sheet piles, $40 per M; white-pine or long-leaf yellow-pine planks for decking, $32 per M; driftbolts, screw bolts, tie-rods, carriage bolts, and spikes, 3 cents per pound; stone, $6.90 per cord.

Dredging.

Contractor: Samuel O. Dixon.
Date of contract: March 25, 1904.
Date of approval: April 15, 1904.
Date of beginning: May 3, 1904.
Date of expiration: September 17, 1904; time limit waived.
Rate: 17½ cents per cubic yard.

Contractor: Chicago and Great Lakes Dredge and Dock Company.
Dated: April 29, 1905.
Approved: May 9, 1905.
Date of beginning: May 27, 1905.
Date of expiration: September 12, 1905.
Rate: 17½ cents per cubic yard.

Excavating new channel from Kalamazoo River to Lake Michigan.

Contractor: Great Lakes Dredge and Dock Company.
Dated: June 16, 1905.
Approved: July 3, 1905.
Date of beginning: July 20, 1905.
Date of expiration: December 5, 1905.
Rate: 9½ cents per cubic yard.

COMMERCIAL STATISTICS FOR SAUGATUCK HARBOR, MICHIGAN, CALENDAR YEAR ENDING DECEMBER 31, 1904.

[Compiled from statement furnished by Mr. Colborn Brittain, of Saugatuck, Mich.]

Character of vessels.	Number.	Tonnage.
Steam, entered and cleared	522	65,082
Sail, entered and cleared	22	678
Total	544	65,760

Maximum draft, 8 feet.

Receipts and shipments by vessel, 1904.

Articles received.	Tons.	Articles shipped.	Tons.
Cedar posts	20	Fruit	3,536
Coal	1,500	Fruit packages, empty	750
Lumber	78	Merchandise, miscellaneous	1,200
Wood	438		
Merchandise, miscellaneous	3,036		
Total	5,072	Total	5,486

	Tons.
Total freight carried in 1903	12,591
Total freight carried in 1904	10,558
Decrease	2,033

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IMPROVEMENT OF HARBOR AT HOLLAND (BLACK LAKE), MICHIGAN.

The history of this work is brought to the close of the last fiscal year in the Report of the Chief of Engineers for 1904, pages 2989–2991.

OPERATIONS DURING FISCAL YEAR ENDING JUNE 30, 1905.

The dredging in progress at the beginning of the fiscal year under the contract with Samuel O. Dixon was completed July 8 and resulted in restoring a channel 120 feet wide and 17 feet deep below zero of gauge at the entrance and on the outer bar and 90 feet wide and 15 feet deep between the piers. The quantity dredged in July was 6,394 cubic yards, price per cubic yard, 17½ cents, making the cost $1,118.95. The channel retained the needed depth until the end of the season, but in the spring of 1905 it was found to have experienced the customary shoaling, the soundings made April 6–12 showing the following condition of the harbor: Outside of the entrance there was an available depth of 12.5 feet on line of north pier, 15.6 feet on a line 60 feet south of north pier, and 18.6 feet on line of south pier. Between the piers the available depth outside of shore line was 11.4 feet in middle of channel, with about 13 feet near each pier. From the shore line to Black Lake there was a depth of 15 feet for a width of about 70 feet. The depths refer to the level of zero of gauge, and the stage of the lake at the time of sounding was — 0.8 to — 1.1 feet. The channel was again improved by dredging under the contract with Chicago and Great Lakes Dredge and Dock Company, dated April 29, 1905, which was begun May 22 and completed June 13, and resulted in providing a depth of 18 feet for a width of 180 feet across the outlying bar, a depth of 17 feet for a width of 120 feet between the outer 300 feet of the piers, and a depth of 15 feet farther inside. The depths refer to the level of zero of gauge. The dredged quantities measured 22,992 cubic yards, price per yard, 17¼ cents, making the cost $3,966.12.

The portion of the north pier between station 9+80 and station 11 became endangered through the failure of the rear piles of the structure, from which the detached wall of sheet piles on the channel side was supported by means of tie-rods, and 15 new piles were driven along the rear wall at equal intervals, and the rear wale was secured to the new piles for the support of the tie-rods. The rear wall of the superstructure was also attached to the new piles by means of screw bolts. This work was done under a special agreement with William F. Van Anrooy, at a cost of $331.75.

During the storm of December 27 the end crib of the south pier was undermined, causing it to tear apart from the pier and to settle below the water surface at the outer end and considerably to the south of its original position.

On April 24 the steamer *Argo*, of the Graham & Morton Line, while entering the harbor ran into the south pier about 150 feet from the outer end, and the upper eight courses for a length of about 10 feet and one set of cross-ties were broken.

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CONDITION OF WORK JUNE 30, 1905.

The navigable condition of the channel has been described under the head of "Operations," as also that of the end crib of the south pier. Otherwise the substructure of the piers and revetments is now in a serviceable condition throughout, but the superstructure of 513 feet in the north pier and of 981 feet in the south pier is much decayed and will soon have to be rebuilt.

WORK PROPOSED FOR FISCAL YEAR ENDING JUNE 30, 1906.

Under the provision in the act of March 3, 1905, "that the United States engineer officer in charge may, subject to the approval of the Chief of Engineers, modify the existing project by the widening of the harbor entrance," a plan was submitted which made a jog, or shoulder, 80 feet to the southward at the outer end of the south pier and then prolonged it and the north pier on parallel lines 300 feet apart, the north pier being in prolongation of its present direction. Further study, especially with a view to overcoming the injurious wave action within this harbor, which is about as bad here as at the harbors named for consideration by a Board of Engineers with the same end in view, under the act of March 3, 1905, caused a renunciation of the first plan, as it would doubtless increase rather than diminish the injurious wave action at landings within the harbor. This study evolved a modification of detached breakwaters such as to embody their good features and yet by connecting what are really converging piers with the outer ends of the present piers, will construct pier extensions with an entrance widened from 200 feet to 300 feet at the same cost that the first plan submitted could be built. A full description, with a limited argument as to the characteristics of this second plan, accompanied by a drawing, was submitted April 29, 1905, and was approved July 12, 1905.

The sheet accompanying illustrates the plan, that may be described as follows: The converging portions of the pier extensions are to be built of the usual form for such structures on this sandy east shore of Lake Michigan, i. e., with square timber cribs, resting on piles cut off at or near lake bottom, surmounted with square timber superstructure, and filled with stone. The connections between the inner ends of the converging portions and the old piers are regarded as important adjuncts, as they are to prevent injurious cross currents that without them would occur across the ends of the old piers when storms were setting onto the shore, and also to prevent accumulations of sand channelward of the converging piers due to such currents. Inasmuch as their location precludes their being assailed by high seas, they can be built of reduced cross section, and as they are to allow inrolling seas that have passed within the entrance to roll over them, this cross section is further reduced by about 4 feet of superstructure. They are to be built of piles driven, 2 feet centers, in rows 16 feet apart, and they are to be cut off at 2 feet above zero of gauge and to be provided with the usual wale, bolts, and tie-rods, and the structure is to be filled with stone. Owing to the project on which the existing modification is based having provided 800 and 700 feet north and south pier extensions, respectively, the present plan is restricted to

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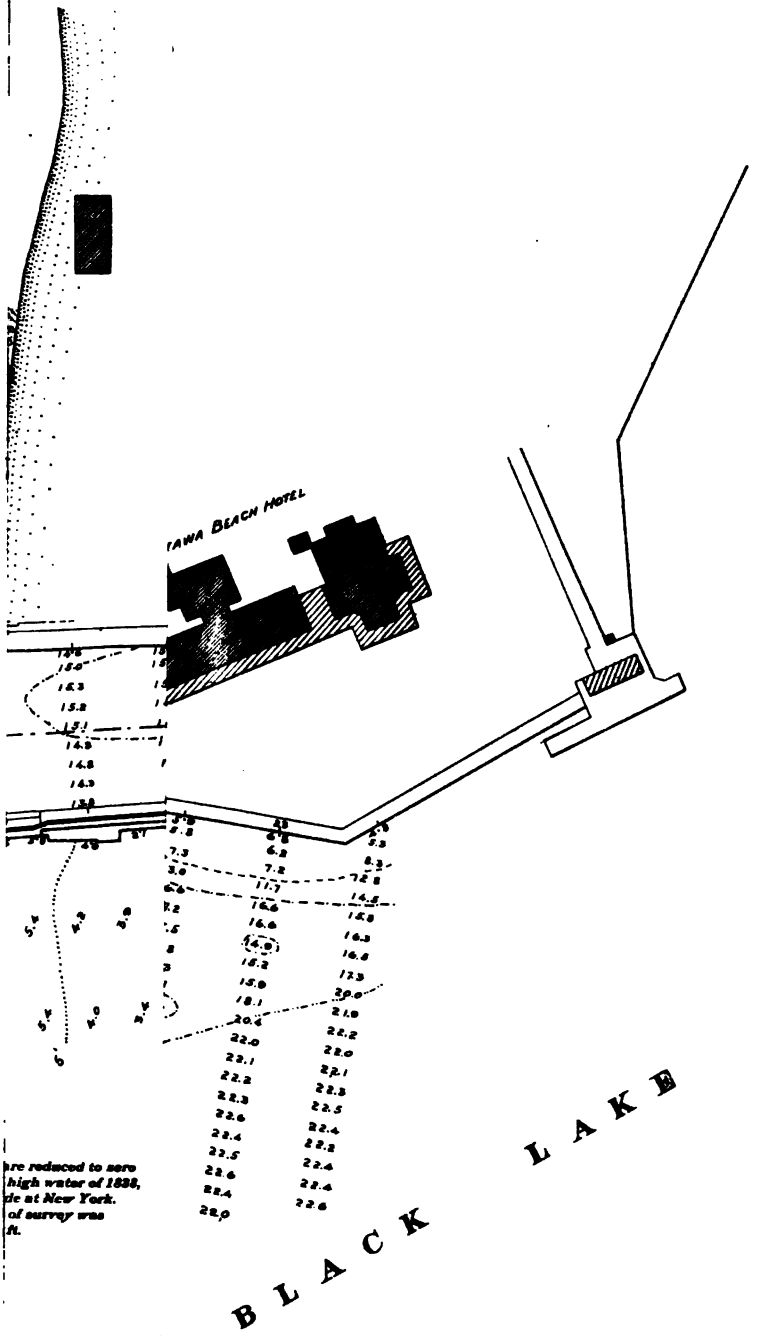

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carrying the extensions to the same distance from the present pierheads; with more extended provision it would seem to have been desirable to make the distance between the 300-foot entrance and the present pierheads (200 feet apart) somewhat greater than is provided in the plan; but assurances have been received from one of the owners and also from one of the masters of the steamboats that frequent the harbor (the Graham & Morton Line) that the distance is ample in which to straighten up their boats for entering the narrow portion between the piers after reaching the entrance in stress of weather. Both the entrance and the present pierhead on one side of the channel are to be lighted.

With the funds available, together with the amount authorized for a continuing contract or contracts by the act of March 3, 1905, it is therefore proposed to provide for the pier extensions, upon the plan approved, by placing the work under contract at as early a date as practicable. Of the balance remaining available, $1,000 will be reserved as part payment of an inspection or survey steamer; $5,000 will be applied to dredging under contract or by the U. S. dredge *Gillespie*, as may appear most advantageous; and $5,000 will be used for incidental repairs, either by contract or day labor, whichever method may be the most economical and advantageous, when the work is required.

ESTIMATE OF FUNDS FOR FISCAL YEAR ENDING JUNE 30, 1907.

The act of March 3, 1905, gives authority for entering into a contract involving the expenditure of $110,000 over and above the amount directly available for additional pier construction, and this amount is therefore included in the present estimate. In addition there should be appropriated $11,000 for dredging the channel to its full capacity in accordance with the requirements of the approved project, and $5,000 for incidental repairs. The sum of these items is $126,000.

Total amount appropriated and allotted to June 30, 1905			$484,315.31
Miscellaneous receipts			1,100.00
			485,415.31
Less amount carried to surplus fund			1.19
			485,414.12
Total amount expended from August, 1852, to March 3, 1899:			
For construction	$176,619.80		
For maintenance	127,597.50		
		$304,217.30	
Total amount expended to June 30, 1905, on project approved March 3, 1899:			
For construction	$54,457.10		
For maintenance	54,827.46		
		109,284.56	
			413,501.86
Balance			71,912.26
Estimated cost of existing project, approved March 3, 1899			240,000.00

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Money statement.

July 1, 1904, balance unexpended		[a]$35,266.23
Amount appropriated by river and harbor act approved March 3, 1905		65,000.00
		100,266.23
June 30, 1905, amount expended during fiscal year:		
For works of improvement	[b]$17,140.00	
For maintenance of improvement	11,213.97	
		28,353.97
July 1, 1905, balance unexpended		71,912.26
July 1, 1905, outstanding liabilities		52.33
July 1, 1905, balance available		71,859.93
July 1, 1905, amount covered by uncompleted contracts		396.62
Amount (estimated) required for completion of existing project		128,296.69
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$121,000.00	
For maintenance of improvement	5,000.00	
		126,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

APPROPRIATIONS.

Black Lake:		Black Lake—Continued.	
August 30, 1852	$8,000.00	September 19, 1890	$10,000.00
June 23, 1866	55,615.31	Holland:	
March 2, 1867	51,000.00	July 13, 1892	5,000.00
July 11, 1870	10,000.00	August 18, 1894	15,000.00
March 3, 1871	10,000.00	June 3, 1896	10,000.00
June 10, 1872	10,000.00	March 3, 1899	37,500.00
March 3, 1873	12,000.00	June 6, 1900 (allotments)	4,200.00
June 23, 1874	15,000.00	June 13, 1902	73,000.00
March 3, 1875	15,000.00	March 3, 1905	65,000.00
August 14, 1876	15,000.00	Miscellaneous receipts	1,100.00
June 18, 1878	10,000.00		
March 3, 1879	6,000.00	Total	485,415.31
June 14, 1880	6,000.00	Amount carried to surplus fund	1.19
March 3, 1881	6,000.00		
August 2, 1882	10,000.00	Balance	485,414.12
July 5, 1884	15,000.00		
August 5, 1886	5,000.00		
August 11, 1888	5,000.00		

ABSTRACT OF CONTRACTS IN FORCE.

Dredging.

Contractor: Samuel O. Dixon.
Date of contract: March 25, 1904.
Date of approval: April 15, 1904.
Date of beginning: May 3, 1904.
Date of expiration: September 17, 1904. (Time limit waived.)
Rate: 17½ cents per cubic yard.

[a] Exclusive of $2,860 expended for dredge to June 30, 1904.
[b] Includes $17,140 for dredge.

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Contractor: Chicago and Great Lakes Dredge and Dock Company.
Dated: April 29, 1905.
Approved: May 9, 1905.
Date of beginning: May 27, 1905.
Date of expiration: September 12, 1905.
Rate: 17¼ cents per cubic yard.

COMMERCIAL STATISTICS FOR HOLLAND (BLACK LAKE) HARBOR, MICHIGAN, CALENDAR YEAR ENDING DECEMBER 31, 1904.

[Compiled from statement furnished by Graham & Morton Line, of Holland, Mich.]

Character of vessels.	Number.	Tonnage.
Steam, entered and cleared	619	744,988
Sail, entered and cleared	3	300
Total	622	745,288

Maximum draft, 14 feet.

Receipts and shipments, by vessel, 1904.

Articles received.	Tons.	Articles shipped.	Tons.
Automobiles	43	Automobiles	66
Flour	167	Fruit	740
Live stock	91	Furniture	687
Lumber	2,090	Leather	430
Soap	57	Live stock	17
Merchandise, miscellaneous	9,181	Potatoes	140
		Sugar	1,902
		Vinegar	1,949
		Merchandise, miscellaneous	3,940
Total	11,629	Total	9,821

	Tons.
Total freight carried in 1903	16,430
Total freight carried in 1904	21,450
Increase	5,020

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IMPROVEMENT OF GRAND HAVEN HARBOR, MICHIGAN.

The history of this work is brought to the close of the last fiscal year in the Report of the Chief of Engineers for 1904, pages 2993–2997.

OPERATIONS DURING FISCAL YEAR ENDING JUNE 30, 1905.

The uncompleted informal contract of last year with Leathem & Smith for riprapping the channel face of the south revetment between stations 35 and 45 was completed in July by depositing an additional quantity of 233.7 cords of stone.

As stated in the last annual report, the part of the south revetment between stations 32+50 and 36+50 was practically destroyed, and the

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filling in the other parts of the revetment between stations 30 and 46+63 was partly washed out or settled badly. Immediate repairs appeared to be imperative in order to prevent the total loss of the work, and a special allotment of $20,000 from the emergency appropriation of April 28, 1904, having been made available on July 9, a contract dated August 17 was entered into with Robert Love for the purpose, the work to be completed December 31, 1904. Operations under this contract were begun August 31, the remainder of the old structure between stations 32+50 and 36+50 above the level of —25 feet was removed, and two specially built cribs, each 200 by 18 by 22 feet, were sunk on a pile-and-stone foundation in this space and completed with a four-course superstructure filled with stone. The face of the work was strengthened with stone riprap extending to station 30+25. The total quantity of stone placed, under this contract, in the foundation, cribs, and riprap was 1,849.34 cords. The filling in the other parts of the revetment between stations 30 and 46+63 was restored by the addition of 367.3 cords brush and 342.54 cords stone. The contract was completed December 17, 1904.

On October 9 the steamer *Indiana*, of the Goodrich Line, ran into the south pier just west of the break caused by the *Atlanta*, of the same line, on April 8, 1904, and caused the break to extend from station 6+89.5 to station 7+42.4 in the top course of the front wall and to 7 feet below the water surface. Immediate arrangements for the complete repairs of the pier were prevented by the lack of funds, but the rear wall in its weakened condition was in danger of being breached, and its preservation required the making of temporary repairs to the center and cross walls. These repairs were commenced October 20, by day labor and material on hand, and completed in December, and they consisted in rebuilding the center wall, strengthening the connection between cross walls and longitudinal walls, filling the space between the rear and center walls with stone taken from other parts of the pier, and decking this space over.

During the storm of December 27 the house over the well of the automatic gauge on the south pier was partly destroyed and the gauge temporarily disabled. The damage was repaired in January.

At the beginning of the fiscal year work was in progress under the contract with the Chicago and Great Lakes Dredge and Dock Company for widening and deepening the channel across the bar and inside, the total quantity of material to be removed being limited to 100,000 cubic yards. This contract was completed July 18, and resulted in producing a depth of 18 feet at the zero stage for a width of 260 feet across the bar on the southern approach to the entrance, and the same depth with a width of 200 feet next to the south pier inside. The quantity dredged in July was 23,423 cubic yards, making a total of 100,000 cubic yards since the beginning of the work on May 13, 1904, and the price per yard was 16.9 cents.

Late in the fall the available depth and width outside of the entrance and between the piers near the outer end had again been reduced to such an extent that serious trouble was experienced by the vessels using the harbor, and an allotment of $10,000 from the emergency appropriation of April 28, 1904, was made available under date of January 17 for reducing the shoal. Owing to the accumulation of ice at the harbor, however, it was not possible to obtain an offer from the dredge owners for doing the work before spring, and then only at

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an exorbitant price, and the early arrival of the new Government seagoing suction dredge *Genl. Gillespie* having in the meantime been assured, it was decided to defer the dredging until it could be done by that dredge.

The condition of the harbor in the spring was ascertained by soundings made May 8–13, which showed the following available depths, referred to the level of zero of gauge: On the outer bar, 17.2 feet on the line of north pier, 16.1 feet on the shoalest point opposite the middle of the entrance, and 20.9 feet on the line of south pier. Between the piers, 17.7 feet for a width of 200 feet next to the south pier at the outer end and greater depths inside. The stage of the lake at the time of soundings was 0.0 to —1.0 foot.

The *Genl. Gillespie* arrived from Ludington on June 24, and began operations on June 26, under instructions for the removal of the outer bar to a depth of 22 feet below the level of zero of gauge, and for widening the channel between the piers. The quantity of sand removed to the end of June was 23,949 cubic yards.

The operations described above cost as follows:

Riprapping south revetment under informal contract with Leathem & Smith	$1,388.18
Repair of south revetment, under contract with Robert Love	32,082.51
Dredging, under contract with Chicago and Great Lakes Dredge and Dock Company	11,977.83

CONDITION OF WORK JUNE 30, 1905.

A number of the breaks in the piers, caused by colliding vessels and enumerated in the last annual report, remain unrepaired, but it is intended to have them attended to before winter.

The new cribwork in the south revetment between stations 32+50 and 36+50 has settled considerably in the center vertically and toward the channel, indicating an insecure foundation in its present condition. The superstructure of 1,107 linear feet of the south pier, station 7+05 E to station 4+02 W., is 21 to 23 years old, and the time has come to provide for rebuilding it. Two hundred and four feet more is 19 to 20 years old. The filling in the pile work from station 4 to station 30 is very low and needs renewal. Fifty feet of the inner end of the north revetment was washed away during the flood of 1904 in Grand River, and 80 feet more was undermined and is practically ruined. Fifteen hundred and twenty-three linear feet of the north revetment, of which the above is a part, is 18 to 20 years old above water, and will soon require a new superstructure, while the filling in it and in the adjacent stretches of 604 feet has badly settled and requires partial renewal. With the above exceptions the Government works are in fair condition. The condition of the channel is as described under the head of operations.

WORK PROPOSED FOR FISCAL YEAR ENDING JUNE 30, 1906.

The act of March 3, 1905, appropriated $30,000 for continuing improvement and for maintenance. This amount, together with the balance of previous appropriations and allotments, is only sufficient to provide for necessary works of maintenance, as follows: The numerous breaks in the work caused by colliding vessels will be repaired; the dredging for the removal of the bar and for widening

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the channel between the piers, now in progress by the U. S. dredge *Gen. Gillespie*, will be completed; the inner end of the north pier will be repaired; about 2,100 feet of the pile work in the north pier and about 2,600 feet in the south pier will be supplied with additional stone for their security and to restore their efficiency; the riprap along the face of the inner portion of the south revetment will be strengthened; $4,300 has been allotted for a survey and inspection steamer, and the remaining balance will be reserved for emergencies. The incidental repairs will be made by day labor and purchased material, and the refilling of piers and the riprapping will be done by contract.

ESTIMATE OF FUNDS FOR FISCAL YEAR ENDING JUNE 30, 1907.

The existing project provides for an extension of 100 feet to the south pier and of 150 feet to the north pier. This, at $125 per linear foot, will cost $31,250. For rebuilding 1,311 feet of the south pier, the amount required is $21,000. The estimate for incidental repairs is $5,000, and for dredging, $10,000. Including contingencies, the total estimate is therefore as follows:

For construction		$34,375.00
For maintenance		39,600.00
Total		73,975.00
Total amount appropriated and allotted to June 30, 1905		869,366.15
Miscellaneous receipts		5,576.92
		874,943.07
Total amount expended from August, 1852, to June 30, 1905:		
For construction	$542,976.82	
For maintenance	288,091.55	
		831,068.37
Balance		43,874.70
Estimated cost of work, 1866, amended in 1880, 1890, and 1892		804,366.15

Money statement.

July 1, 1904, balance unexpended	$33,042.30
Amount appropriated by river and harbor act approved March 3, 1905	30,000.00
Amount allotted from appropriation for maintenance of river and harbor improvements, act of April 28, 1904	30,000.00
	93,042.30
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	[a] 49,167.60
July 1, 1905, balance unexpended	43,874.70
July 1, 1905, outstanding liabilities	375.35
July 1, 1905, balance available	43,499.35
Amount (estimated) required for completion of existing project	34,375.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:	
For works of improvement	$34,375.00
For maintenance of improvement	39,600.00
	73,975.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

[a] Includes $1,000 for dredge.

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APPROPRIATIONS.

August 30, 1852 (mouth of Grand River)	$2,000.00
June 23, 1866	65,000.00
March 2, 1867 (mouth of Grand River)	40,000.00
April 10, 1869 (allotment)	1,866.15
July 11, 1870	10,000.00
1870 (allotment)	500.00
March 3, 1871	6,000.00
June 10, 1872	15,000.00
March 3, 1873	75,000.00
June 23, 1874	50,000.00
August 14, 1876	15,000.00
June 18, 1878	15,000.00
March 3, 1879	9,000.00
June 14, 1880	50,000.00
March 3, 1881	50,000.00
August 2, 1882	$40,000.00
July 5, 1884	50,000.00
August 5, 1886	30,000.00
August 11, 1888	25,000.00
September 19, 1890	75,000.00
July 13, 1892	90,000.00
August 18, 1894	25,000.00
June 3, 1896	20,000.00
March 3, 1899	10,000.00
June 13, 1902	10,000.00
June 13, 1902 (allotment)	10,000.00
April 28, 1904 (allotments)	50,000.00
March 3, 1905	30,000.00
Miscellaneous receipts	5,576.92
Total	874,943.07

ABSTRACT OF CONTRACTS IN FORCE.

Emergency contract for dredging.

Contractor: Chicago and Great Lakes Dredge and Dock Company.
Date of contract: April 29, 1904.
Date of beginning: May 5, 1904.
Date of expiration: To be prosecuted continuously until completion.
Rate: 16.9 cents per cubic yard.

Emergency contract for repair of south pier.

Contractor: Robert Love.
Dated: August 17, 1904.
Date of beginning: August 23, 1904.
Date of expiration: December 31, 1904.
Rates: Removing old work and excavating site of new cribs, lump sum of $2,000; foundation piles, 60 cents per linear foot; white-pine or longleaf yellow-pine timber, $33 per thousand; hemlock timber, $23 per thousand; white-pine or longleaf yellow-pine plank, $32 per thousand; driftbolts, screw bolts, and spikes, 3 cents per pound; stone, $8.50 per cord of 128 cubic feet; edgings or brush, $5 per cord of 128 cubic feet.

COMMERCIAL STATISTICS FOR GRAND HAVEN HARBOR, MICHIGAN, CALENDAR YEAR ENDING DECEMBER 31, 1904.

[Compiled from statement furnished by deputy collector of customs at Grand Haven, Mich.]

Character of vessels.	Number.	Tonnage.
Steam, entered and cleared	1,219	1,485,877
Sail, entered and cleared	28	769
Total	1,247	1,486,646

Maximum draft, 17 feet.

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Receipts and shipments by vessel, 1904.

Articles received.	Tons.	Articles shipped.	Tons.
Building materials	111,205	Coal	9,527
Feed	174,345	Leather and hides	1,590
Flour	46,042	Lime and cement	3,793
Grain	13,926	Pulp	4,564
Iron ore	38,861	Salt	1,098
Merchandise, miscellaneous	35,016	Sugar	2,049
		Merchandise, miscellaneous	29,333
Total	419,395	Total	51,954

	Tons.
Total freight carried in 1904	471,349
Total freight carried in 1903	215,184
Increase	256,165

M M 7.

IMPROVEMENT OF GRAND RIVER, MICHIGAN.

The history of this improvement to June 30, 1904, will be found in the Report of the Chief of Engineers for 1902, page 2159; for 1903, page 1956, and for 1904, page 2999.

OPERATIONS DURING FISCAL YEAR ENDING JUNE 30, 1905.

Operations by day labor and the use of Government plant have been in progress during the year. The U. S. suction dredge *Ludlow*, which was at work on the Lamont bar (16 miles below Grand Rapids) at the close of the last fiscal year, continued dredging narrow channels through all bars having less than 5 feet of water on them (at extreme low water) between the third and sixteenth miles; and the U. S. dipper dredge *Farquhar* completed a single cut through the Noble, Salt Works, Howlett, Glenn Creek, Clamshell, Jenison, Snyder, and Haires bars before the close of the season. On October 22 a navigable channel 4.5 feet deep at low water had been completed between Grand Rapids and the mouth of Bass River, 23 miles below. From Bass River to Grand Haven there existed a natural channel of that depth. The available funds having been nearly exhausted, the plant was taken to Grand Haven and stored for the winter season. The work of repairing and fitting out the dredging plant was begun March 27. The *Farquhar* commenced operations on the County House bar April 27, and the *Ludlow* on the Eastmanville bar May 1. From June 7 to June 16 these dredges were unable to work on account of an extremely high stage of the river. As a result of heavy rainfalls the river began to rise on June 5, and on June 9 the crest of the flood passed Grand Rapids, registering on the gauge there +25.4. This is a rise of 19.6 feet above the low water, and only 1 foot less than the record flood of 1904. The work of the dredges during May and June of this season has resulted in completing the channel for a distance of 4 miles (from mile 18½ to mile 22½). The material dredged during the fiscal year consisted of sand, clay, cobblestones,

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and bowlders, with sand predominating, and amounted to 619,259 cubic yards, at a cost of 3.5 cents per cubic yard.

The construction of contraction works this year consisted in completing training walls, which, on account of a high stage of water, were not completed during the fiscal year ending June 30, 1904. Between the fifth and eighth miles below Grand Rapids new walls, aggregating 3,459 linear feet, were completed during this year. In addition to this work old walls were repaired, by filling in brush where it had shrunk away, rebinding the tops of walls, and cutting off the tops of the piles which had been lifted by the ice. This work was carried on between the fifth and twenty-third miles, and amounted to 43,889 linear feet of old wall repaired. On September 18 this work having been finished, the plant was taken to Grand Haven and stored. The repairing and fitting out of contraction works plant was begun early in May, 1905, but owing to a continued high stage of the river, no actual construction or repair work could be commenced before the close of the fiscal year.

The foregoing operations cost as follows:

Dredging	$21,700.99
Contraction works:	
Construction	243.28
Maintenance	1,983.27

CONDITION OF WORK JUNE 30, 1905.

The total distance from Fulton street, Grand Rapids, Mich., to Washington street, Grand Haven (the inner end of Grand Haven Harbor), is about 39½ miles. In this distance there is a navigable channel (narrow in places) of 6 feet at extreme low water for an aggregate length of 27.3 miles. The total length of channel 5 feet to 6 feet deep at low water is 8.86 miles. The total length of channel having depths less than 5 feet at low water is 3.34 miles. The least depth found at any point is 3.1 feet.

Two boats of about 100 tons burden each are now being constructed by the Grand Rapids and Lake Michigan Transportation Company to do a freight and passenger business between Grand Rapids and Grand Haven, Mich. It is expected that they will begin to run in September, 1905. These boats will draw, loaded, about 34 inches.

The contraction works have sustained only slight damage from the ice during the year.

WORK PROPOSED FOR FISCAL YEAR ENDING JUNE 30, 1905.

The dredging operations which are now in progress will be continued throughout the year. Providing the stage of the river will permit, it is proposed to construct approximately 25,000 linear feet of training wall in continuation of the works already made. Only such repairs to contraction works will be made as are absolutely necessary to save the existing works and protect the spoil banks.

ESTIMATE OF FUNDS FOR FISCAL YEAR ENDING JUNE 30, 1905.

By act of Congress March 3, 1905, the project was modified to provide for a 6-foot instead of a 10-foot depth of channel, in accordance

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with the report of the Board of Engineers (dated November 11, 1903) and contained in House Document No. 216, Fifty-eighth Congress, second session, which says:

[First.] The Board, therefore, believes that it is advisable to modify the project for the improvement of Grand River, with a view to securing and maintaining a 6-foot channel 100 feet wide from Fulton street, Grand Rapids, to Grand Haven, Mich., at a cost of $327,000, in addition to plant and funds now available. [Second.] The cost of maintaining a 6-foot channel may be estimated at $20,000. [Third.] The above estimate is based upon the supposition that the entire amount be made available for work with the United States plant not later than one year hence.

On this recommendation an appropriation of $100,000 was made March 3 1905. There yet remains to be appropriated $227,000 to complete the work, and it thought that the whole amount should be provided. In addition to this, $10,000 should be provided for the maintenance of those portions of the channel which have been entirely completed. Therefore, nothing less than $237,000 should be provided for the completion of this work.

Total amount appropriated to June 30, 1905		$425,000.00
Miscellaneous receipts		83.65
		425,083.65
Total amount expended on previous projects from March, 1881, to June, 1896		50,000.00
		375,083.65
Total amount expended on present project, approved June 3, 1896:		
For construction	$261,329.15	
For maintenance	13,427.45	
		274,756.60
Balance		100,327.05
Original estimated cost, project 1896, as amended by act June 13, 1902		774,000.00
Estimated cost present project, approved March 3, 1905		430,000.00

Money statement.

July 1, 1904, balance unexpended		$39,613.30
Amount appropriated by river and harbor act approved March 3, 1905		100,000.00
Deposits September 30 and December 19		83.65
		139,696.95
June 30, 1905, amount expended during fiscal year:		
For works of improvement	[a]$36,944.27	
For maintenance of improvement	2,425.63	
		39,369.90
July 1, 1905, balance unexpended		100,327.05
July 1, 1905, outstanding liabilities		3,739.72
July 1, 1905, balance available		96,587.33
Amount (estimated) required for completion of existing project		227,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$227,000.00	
For maintenance of improvement	10,000.00	
		237,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of river and harbor act of 1899.

[a] Includes $10,000 for dredge *Gillespie*.

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APPROPRIATIONS.

March 3, 1881	$10,000.00	June 13, 1902	$150,000.00
August 2, 1882	15,000.00	March 3, 1905	100,000.00
July 5, 1884	25,000.00	Miscellaneous receipts	83.65
June 3, 1896	50,000.00		
March 3, 1899	75,000.00	Total	425,083.65

COMMERCIAL STATISTICS FOR GRAND RIVER, MICHIGAN, CALENDAR YEAR ENDING DECEMBER 31, 1904.

[Compiled from statement furnished by Mr. Fred. Kendrick, United States watchman, Grand Haven, Mich.]

Freight carried on Grand River, 1904.

Articles.	Tons.
Brick	375
Gravel, etc	12,447
Iron ore[a]	38,861
Logs	24,982
Lumber, posts, etc	1,556
Merchandise, miscellaneous	70
Total	78,291

[a] To Fruitport, Mich.

	Tons.
Total freight carried in 1903	83,332
Total freight carried in 1904	78,291
Decrease	5,041

M M 8.

IMPROVEMENT OF MUSKEGON HARBOR, MICHIGAN.

The history of this improvement to the close of the last fiscal year is found in the Report of the Chief of Engineers for 1904, pages 3007–3010.

OPERATIONS DURING FISCAL YEAR ENDING JUNE 30, 1905.

The vacancies in the side pockets of the south pier between stations 10+82 and 16+85 and at the outer end of the pier were refilled with 152.85 cords stone. This work was done in July under an informal contract with Leathem & Smith, and cost $984.35.

Dredging for the restoration of the customary width and depth of channel begun by contractor Samuel O. Dixon on August 8 and completed September 7. Four adjacent cuts, each 30 feet wide and 20 feet deep below the zero level, and varying in length from 200 to 335 feet, were made at the entrance, and five adjacent cuts, each 30 feet wide and 20 feet deep, and varying in length from 415 to 1,100 feet, were made between the piers. The practical result of the dredging was a depth of 19 feet below zero of gauge for the full width of the channel at the end of the piers, a depth of 18 feet for 180 feet width next to the south pier, between the projecting part of the piers, and the same depth for a width of 120 feet at shore line. The dredged

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quantity was 21,875 cubic yards and the price per cubic yard 17½ cents, making the cost $3,828.12.

On the night of September 13 the south pier was damaged by the steamer *Charles H. Hackley*, of the Barry Line, as follows: Between stations 13+52 and 14 the front wall and several cross walls were destroyed for a depth of about 11 feet below the top of the work, and a considerable portion of the stone filling was lost. Between stations 10+44.3 and 10+62.3 the upper five courses of the front wall were cut through. Besides the steamer bruised the front wall in a number of places without actually breaking any timber, except the top one near station 9+40 for a length of about 4 feet. These breaks were repaired in October and November by day labor and purchased material, and the cost ($586.72) placed in the hands of the United States district attorney for collection from the owners of the boat.

On February 22 the steamer *Naomi*, of the Crosby Line, ran into the south pier and broke the front wale, the superstructure, and the plank walk between stations 34+60.5 and 34+90.7 E. This damage was repaired by the owners of the steamer in April.

CONDITION OF WORK JUNE 30, 1905.

The north pier and revetment comprise a total length of 2,780 feet, consisting of 1,176 feet of pile work and 1,604 feet of cribwork. The project provides for the removal of the easterly 1,826 feet of the existing structure when the interior channel is widened to 300 feet. Of the remaining outer portion about 350 feet are 19 to 20 years old and will soon need a new superstructure. The rest is in good condition. The two sections of the south pier and revetment have an aggregate length of 4,402 feet, and consist of 2,947 feet of pile work and 1,455 feet of cribwork. The pier is generally in good condition, but 250 feet, 21 years old, need new superstructure. The south bank of the interior channel, between the east end of the Government revetment at station 13+20 and the car-ferry slip, was formerly used by the Pere Marquette Railroad Company as a landing for their steamers, and a warehouse occupied it for nearly the entire distance mentioned. This use has now been discontinued, the warehouse has been removed, and the unprotected bank, about 310 feet in length, is being abraded by the waves and the material washed into the channel.

Soundings of June 3–8 showed the following available depths: Outside, 27.5 feet on line of south pier, 24.5 feet 100 feet north of that line, 17 feet 200 feet north of line of south pier, and 18 feet on line of north pier; at outer end of piers, 20 feet for width of 150 feet next to south pier; at shore line, 17 feet for width of 160 feet, and thence to Muskegon Lake not less than 16 feet in mid-channel. The stage of the lake at time of sounding was +0.1 to —0.1 foot. The depths refer to the level of zero of gauge.

WORK PROPOSED FOR FISCAL YEAR ENDING JUNE 30, 1906.

The river and harbor act of March 3, 1905, appropriated $100,000 for continuing improvement and for maintenance. This amount,

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together with the balance of previous appropriations, will be expended as follows: For dredging during the seasons of 1905 and 1906 with the U. S. dredge *General Gillespie*, $20,000; for general repairs, $5,000, and the rest for building 310 linear feet of sheet pile revetment for the protection of the south bank between the east end of the Government revetment at station 13+20 and the car-ferry slip of the Pere Marquette Railroad, and for building 2,000 linear feet of the proposed new north pier and revetment. Before the latter work can be undertaken the United States must acquire legal possession of the land required in order to widen the channel in accordance with the approved project. A deed of this land has been received from the owners, the Central Land Company (Pere Marquette Railroad), and it has been forwarded to the Department for decision as to its validity. When this matter is satisfactorily settled, steps will be taken at once for placing the work under contract, and it is expected that it will be completed by the close of the working season of 1906.

ESTIMATE OF FUNDS FOR FISCAL YEAR ENDING JUNE 30, 1907.

In addition to the work which it is proposed to do with the funds now available, the approved project provides for 550 feet of pier extension (200 feet on south side and 350 feet on north side), the removal of 712 feet of old north pier and revetment, the construction of 2,300 feet of sheet pile revetment on the north side, and for dredging the harbor to a depth of 20 feet for the full width of 300 feet. The cost of this work, based upon the prices of the original estimate, will be $216,300. The estimate for maintenance by dredging and incidental repairs is $10,000, making the total estimate $226,300.

Total amount appropriated and allotted to June 30, 1905			$704,500.00
Miscellaneous receipts			110.00
			704,610.00
Total amount expended on project, 1866, amended 1869, 1873, 1881, 1884, 1890, 1892, and 1899:			
For construction	$388,218.42		
For maintenance	138,074.94		
		$526,293.36	
Total amount expended on project approved June 30, 1902:			
For construction	$47,810.33		
For maintenance	23,995.82		
		71,806.15	
			598,099.51
Balance			106,510.49
Original estimated cost of work, 1866, amended 1869, 1873, 1881, 1884, 1890, 1892, and 1899			596,000.00
Estimated cost, revised project, approved June 13, 1902			380,000.00

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Money statement.

July 1, 1904, balance unexpended	$14,030.39
Amount appropriated by river and harbor act approved March 3, 1905	100,000.00
	114,030.39
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	[a]7,519.90
July 1, 1905, balance unexpended	106,510.49
July 1, 1905, outstanding liabilities	88.30
July 1, 1905, balance available	106,422.19
Amount (estimated) required for completion of existing project	216,300.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:	
For works of improvement	$216,300.00
For maintenance of improvement	10,000.00
	226,300.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

APPROPRIATIONS.

March 2, 1867	$59,000	August 11, 1888	$45,000
July 11, 1870	10,000	September 19, 1890	50,000
March 3, 1871	15,000	July 13, 1892	75,000
June 10, 1872	10,000	August 18, 1894	30,000
June 23, 1874	10,000	June 3, 1896	30,000
March 3, 1875	25,000	March 3, 1899	60,000
August 14, 1876	15,000	June 6, 1900 (allotments)	5,500
March 3, 1879	5,000	June 13, 1902	75,000
June 14, 1880	7,500	March 3, 1905	100,000
March 3, 1881	20,000	Miscellaneous receipts	110
August 2, 1882	25,000		
July 5, 1884	20,000	Total	704,610
August 5, 1886	12,500		

ABSTRACT OF CONTRACTS IN FORCE.

Dredging.

Contractor: Samuel O. Dixon.
Date of contract: March 25, 1904.
Date of approval: April 15, 1904.
Date of beginning: May 3, 1904.
Date of expiration: September 17, 1904; time limit waived.
Rate: 17½ cents per cubic yard.

COMMERCIAL STATISTICS FOR MUSKEGON HARBOR, MICHIGAN, CALENDAR YEAR ENDING DECEMBER 31, 1904.

[Compiled from statement furnished by deputy collector of customs at Muskegon, Mich.]

Character of vessels.	Number.	Tonnage.
Steam, entered and cleared	922	942,527
Sail, entered and cleared	153	18,135
Total	1,075	960,662

Maximum draft, 17 feet.

[a] Includes $943.74 for dredge.

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Receipts and shipments by vessel, 1904.

Articles received.	Tons.	Articles shipped.	Tons.
Coal	5,796	Coal	3,154
Flour	60	Fruit	258
Iron	10	Iron	413
Laths	607	Lumber	20,540
Lumber	21,441	Sawdust	78
Malt	81	Slabs	1,625
Piles	284	Wood	510
Shingles	1,760	Merchandise, miscellaneous	51,906
Stone	7,125		
Wood	142		
Merchandise, miscellaneous	41,374		
Total	78,630	Total	78,479

	Tons.
Total freight carried in 1903	174,353
Total freight carried in 1904	157,109
Decrease	17,244

M M 9.

IMPROVEMENT OF HARBORS AT WHITE LAKE AND PENTWATER, MICHIGAN.

These harbors were formerly carried as separate works, but are now combined in consequence of the requirements of the river and harbor act of June 13, 1902.

The history of these works is brought to July 1, 1904, in the Report of the Chief of Engineers for 1904, pages 3011–3014.

OPERATIONS DURING FISCAL YEAR ENDING JUNE 30, 1905.

(A) WHITE LAKE HARBOR.

Between August 8 and 19 the harbor was dredged under the contract with Samuel O. Dixon, and a depth of 15 feet below zero of guage for a width of 150 feet next to the south pier at the entrance and a depth of 13 feet for a width of 60 feet in mid-channel between the piers was restored. The quantity of sand removed was 10,253 cubic yards; price per yard, 17½ cents, making the cost $1,794.27.

Soundings made April 28 to May 2 showed the following available depths, referred to level of zero of gauge: Outside of the entrance, 17.8 feet on line of south pier, decreasing to 11.7 feet on line of north pier. Between the piers the best water for 400 feet at the outer end was next to the south pier, with 12.3 feet, and thence to White Lake, in mid-channel, with 14 feet. The stage of the lake at time of sounding was —0.7 to —1 foot. To improve this condition, dredging was again begun June 26, under contract dated April 29, 1905, with the Chicago and Great Lakes Dredge and Dock Company, and at the end of the month three adjacent cuts, each 30 feet wide and 18 feet deep and varying in length from 160 to 220 feet, had been made at entrance, and one cut 480 feet long, 30 feet wide, and 16 feet deep between the piers. The depths refer to the level of zero of gauge. The dredged quantity was 5,176 cubic yards, and the price per yard 17¼ cents, making the cost $892.86.

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(B) PENTWATER HARBOR.

On July 13 Contractor Samuel O. Dixon commenced dredging for the temporary restoration of the required depth of navigation, and completed the same on August 2. The dredging resulted in restoring a channel 120 feet wide and 16 feet deep below zero of gauge at the entrance and through the outlying bar and about 60 feet wide and 14 feet deep inside. The dredged quantity was 15,852 cubic yards; price per cubic yard, 17½ cents, and the cost $2,774.10.

Under date of April 29 a contract was entered into with the Chicago and Great Lakes Dredge and Dock Company for doing the required dredging during the present season. Operations are expected to be commenced under this contract in July.

Soundings made April 26 showed the following available depths: Outside there was 12.2 feet on line of north pier; 15.3 feet 50 feet south of that line, and 14.2 feet farther south. Between the piers there was 15 feet for a width of 100 feet next to north pier at outer end, and thence to Pentwater Lake 13.5 feet in middle of channel. The depths refer to the level of zero of gauge. The stage of lake at time of sounding was —0.7 foot.

CONDITION OF WORKS JUNE 30, 1905.

The works at White Lake are in fair condition, except 105 feet of cribwork in south pier, which is 22 years old and will require a new superstructure before long. The condition of the channel is described under the head of operations.

The timber work of the piers at Pentwater is in good or fair condition, except at the outer end of the north pier, where the substructure has settled away from the superstructure, and at the inner end of the first crib, where there is a large hole below water in the front wall. The filling in the pile work of both piers has settled greatly and needs replenishing. The condition of the channel is described under the head of operations.

WORK PROPOSED FOR FISCAL YEAR ENDING JUNE 30, 1906.

The river and harbor act of March 3, 1905, appropriated $20,000 for the maintenance of these two harbors, and of this amount $8,000 has been allotted to White Lake and $12,000 to Pentwater. These amounts, together with the balances remaining available from previous appropriations, will be applied as follows:

At White Lake Harbor $500 has been reserved as part payment of an inspection and survey boat, the dredging now in progress will be completed, $3,300 will be reserved for dredging in 1906, and the remainder will be set aside for incidental repairs.

For Pentwater Harbor the amount of $500 has been allotted as part payment of an inspection steamer, $6,600 will be expended for needed dredging in 1905 and 1906, and the balance will be applied to the repairs and refilling of the piers.

The preliminary examination at Pentwater Harbor, required under section 9, act March 3, 1905, is expected to be made in the near future. This examination has in view a harbor of 16 feet depth.

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ESTIMATE OF FUNDS FOR FISCAL YEAR ENDING JUNE 30, 1907.

At White Lake, to complete the existing project, there remains the extension of the north pier by 50 feet and of the south pier by 100 feet, at a total cost of $18,100. The estimate for repairs and dredging is $10,000, making the total estimate as follows:

For construction	$18,100
For maintenance	10,000
Total	28,100

At Pentwater the approved project provides for an extension to the south pier of 200 feet, at an estimated cost of $22,000. Under the head of maintenance provision should be made for the repairs and support of the sinking end crib of the north pier, for incidental repairs, and for dredging, requiring $12,000. The estimate is therefore as follows:

For construction	$22,000
For maintenance	12,000
Total	34,000

WHITE LAKE HARBOR.

Total amount appropriated and allotted to June 30, 1905		$347,550.00
Total amount expended on project, 1866, amended in 1873, 1884, 1892, and 1898:		
For construction	$207,862.44	
For maintenance	129,463.52	
		337,325.96
Balance		10,224.04
Original estimated cost, 1866, amended in 1873, 1884, 1892, and 1898		353,550.00

Money statement.

July 1, 1904, balance unexpended		$4,154.69
Amount appropriated by river and harbor act approved March 3, 1905		8,000.00
		12,154.69
June 30, 1905, amount expended during fiscal year, for maintenance of improvement		1,930.65
July 1, 1905, balance unexpended		10,224.04
July 1, 1905, outstanding liabilities		30.00
July 1, 1905, balance available		10,194.04
July 1, 1905, amount covered by uncompleted contracts		3,000.00
Amount (estimated) required for completion of existing project		18,100.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$18,100.00	
For maintenance of improvement	10,000.00	
		28,100.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

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PENTWATER HARBOR.

Total amount appropriated and allotted to June 30, 1905		$305,820.00
Total amount expended on project, 1866, amended in 1873, 1884, and 1892:		
For construction	$179,873.15	
For maintenance	111,055.41	
		290,928.56
Balance		14,891.44
Original estimated cost, 1867, amended 1873, 1884, and 1892		327,713.40

Money statement.

July 1, 1904, balance unexpended	$5,828.49
Amount appropriated by river and-harbor act approved March 3, 1905	12,000.00
	17,828.49
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	2,937.05
July 1, 1905, balance unexpended	14,891.44
July 1, 1905, amount covered by uncompleted contracts	3,000.00
Amount (estimated) required for completion of existing project	22,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:	
For works of improvement	$22,000.00
For maintenance of improvement	12,000.00
	34,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

APPROPRIATIONS.

Date.	Pentwater.	White Lake.	Total.
March 2, 1867	$55,000	$57,000	$112,000
April 10, 1869 (allotment)	17,820	44,550	62,370
July 11, 1870	10,000	20,000	30,000
March 3, 1871	10,000	20,000	30,000
June 10, 1872	30,000	10,000	40,000
March 3, 1873	20,000	7,000	27,000
June 23, 1874		10,000	10,000
March 3, 1875		10,000	10,000
August 14, 1876	10,000	5,000	15,000
June 18, 1878	10,000	12,000	22,000
March 3, 1879	6,000	7,500	13,500
June 14, 1880	4,000	5,000	9,000
March 3, 1881	10,000	7,500	17,500
August 2, 1882	10,000	12,000	22,000
July 5, 1884	15,000	10,000	25,000
August 5, 1886	10,000	10,000	20,000
August 11, 1888	8,000	10,000	18,000
September 19, 1890	8,000	17,000	25,000
July 13, 1892	5,000	5,000	10,000
August 18, 1894	5,000	5,000	10,000
June 3, 1896	5,000	5,000	10,000
March 3, 1899	25,000	35,000	60,000
June 13, 1902	20,000	15,000	35,000
March 3, 1905	12,000	8,000	20,000
Total	305,820	347,550	653,370

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ABSTRACT OF CONTRACTS IN FORCE.

HARBORS AT PENTWATER AND WHITE LAKE.

Dredging.

Contractor: Samuel O. Dixon.
Date of contract: March 25, 1904.
Date of approval: April 15, 1904.
Date of beginning: May 3, 1904.
Date of expiration: September 17, 1904. (Time limit waived.)
Rate: 17½ cents per cubic yard.

Contractor: Chicago and Great Lakes Dredge and Dock Company.
Date of contract: April 29, 1905.
Date of approval: May 9, 1905.
Date of beginning: May 27, 1905.
Date of expiration: September 12, 1905.
Rate: 17½ cents per cubic yard.

COMMERCIAL STATISTICS.

No data relative to the commercial statistics for White Lake Harbor could be obtained.

Pentwater Harbor, Michigan, calendar year ending December 31, 1904.

[Compiled from statement furnished by the village president at Pentwater, Mich.]

Character of vessels.	Number.	Tonnage.
Steam, entered and cleared	1,148	392,166
Sail, entered and cleared	142	14,200
Total	1,290	406,366

Receipts and shipments by vessel, 1904.

Articles received.	Tons.	Articles shipped.	Tons.
Merchandise, miscellaneous	3,000	Fruit, potatoes, etc	12,423

M M 10.

IMPROVEMENT OF HARBOR AT LUDINGTON, MICHIGAN.

The history of this improvement is brought to the beginning of the fiscal year in Report of the Chief of Engineers for 1904, pages 3016–2020.

OPERATIONS DURING FISCAL YEAR ENDING JUNE 30, 1905.

Operations on the extension and repairs of the piers and revetments under the contract with T. J. Bennett & Co. were continued, and finally completed on September 3. The details of the operations under this contract since July 1 are as follows: On the north pier extension the top course of the superstructure between station 23+31.2 and station 24+40.6 was put in place, the guard timbers at the outer

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end were secured, 261 cords stone were added to the filling, the decking was put on, and the end crib was protected with 115 cords of heavy riprap. On the extension of the south pier the decking was completed. On the north revetment, between station 0 and station 5+88, the plank walk was put in place and some portions, which had been damaged by colliding vessels, were repaired. On the north pier, between stations 12+37 and 14+87, the ends of the tie-rods were cut off and upset, as required by the specifications. On the south pier, between station 11+73 and station 15+79.5, the remainder of the old work above grade was removed, the substructure between station 16+45 and station 16+61 was repaired, the six courses of superstructure were completed, filled with stone, and decked over. The low rear projection of the crib substructure between stations 14+77 and 16+81.5 was decked over. Some vacancies in the pockets of the south pier, between station 16+80 and station 22+50, were refilled with 42.58 cords stone, and the decking of the north pier, between station 11+79 and station 20+21, and of the south pier, between station 20+78 and station 23+79, was repaired. The cost of the foregoing operations was $16,335.30.

Soundings made April 20–22 showed the following available depths: Outside there was 18.2 feet on line of north pier, 19.5 feet opposite the middle of entrance, and 17.7 feet on line of south pier. The channel between the piers had a depth of 20 feet for a width of 120 feet at the outer end, and for a width of 70 to 80 feet thence to Pere Marquette Lake, except about 300 feet from the east end of the piers, where the width was reduced to 40 feet. The stated depths refer to the stage of zero of gauge. The stage of lake at time of sounding was —0.7 to —0.9 foot.

On June 8 the United States seagoing suction dredge *General Gillespie* arrived from Boston, and, after refitting, she began work on June 14, under instructions to remove the existing shoals at the entrance and between the piers to a depth of 20 feet at the zero stage. This work was completed June 23 and the dredge was then sent to Grand Haven. The quantity of sand removed was 20,417 cubic yards.

The following instances of damage to the piers were reported during the year: On the night of September 22 the Pere Marquette Railroad Company's car ferry *P. M. No. 4* struck the north pier about 300 feet east of the life-saving station, and broomed the top timber and some cross-ties for a distance of about 300 feet. On January 31 the car ferry *P. M. No. 20* ran into the north pier and broke the three top courses of the front wall, between station 9+92.4 and station 10+22.5, and three cross-ties.

CONDITION OF WORK JUNE 30, 1905.

The piers and revetments of the entrance channel are in good condition, with the exception of the parts damaged by colliding vessels and the stone filling in crib intervals and some pockets of the projecting parts of the piers. The north bank, immediately east of the new revetment just constructed, has been seriously abraded by the waves running in through the improved channel during westerly storms, and complaints have been received that at such times vessels can not safely

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lie at the docks of the Pere Marquette Railroad Company on the east shore of Pere Marquette Lake, in front of the entrance.

The condition of the channel is as stated under the head of "Operations."

WORK PROPOSED FOR FISCAL YEAR ENDING JUNE 30, 1906.

The river and harbor act of March 3, 1905, appropriated $10,000, to be expended for maintenance. The balance from previous appropriations is $45,451.56, making the total amount available $55,451.56. The act of March 3, 1905, directs that a Board of Engineers be appointed to inquire into the effect of wave action as injuriously affecting the harbors at Ludington, Mich., etc., and to report at the earliest practicable date what plan of improvement it is desirable to adopt to overcome such wave action. The Board shall further investigate and report as to whether, in the interests of economy, further repairs and construction of piers in such harbors and in those similarly situated should be made of cement or other permanent substance. This provision indicates that no further work of construction shall be done until the report, thereby directed, formulating a plan of improvement to be followed, has been made. It is therefore proposed to confine the work to be done during the year ending June 30, 1906, to maintenance, and so much of $20,000 as has not already been expended for the dredging operations in June, will be applied to further dredging by the *General Gillespie;* $5,000 will be reserved for the repairs of the harbor structures, as occasion may arise, and the balance of the available funds will be reserved for application as may be indicated by the report of the Board of Engineers.

ESTIMATE OF FUNDS FOR FISCAL YEAR ENDING JUNE 30, 1907.

Until the report of the Board of Engineers shall make it possible to prepare plans for future construction, no estimate for this purpose can be made. The estimate for maintenance by dredging and repairs is $20,000.

Total amount appropriated and allotted to June 30, 1905		$663,435.00
Miscellaneous receipts		.42
		663,435.42
Less amount carried to surplus fund		.90
		663,434.52
Total amount expended on project 1867, amended 1885, 1889, 1890, and 1899:		
For construction	$491,416.22	
For maintenance	115,742.98	
		607,159.20
Balance		56,275.32
Original estimated cost of work 1867, revised 1890		381,682.00
Estimated cost of modified project approved March 3, 1899		210,000.00

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Money statement.

July 1, 1904, balance unexpended		[a] $87,662.32
Amount appropriated by river and harbor act approved March 3, 1905		10,000.00
Deposited December 19, 1904		.42
		97,662.74
June 30, 1905, amount expended during fiscal year:		
For works of improvement	[b] $32,847.60	
For maintenance of improvement	8,539.82	
		41,387.42
July 1, 1905, balance unexpended		56,275.32
July 1, 1905, outstanding liabilities		[c] 823.76
July 1, 1905, balance available		55,451.56
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905		20,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

APPROPRIATIONS.

March 2, 1867	$50,000.00	August 11, 1888	$60,000.00
April 10, 1869 (allotment)	31,185.00	July 13, 1892	5,000.00
July 11, 1870	10,000.00	August 18, 1894	6,000.00
March 3, 1871	10,000.00	June 3, 1896	25,000.00
June 10, 1872	10,000.00	March 3, 1899	25,000.00
March 3, 1873	25,000.00	June 13, 1902	75,000.00
June 23, 1874	20,000.00	March 3, 1903	165,000.00
March 3, 1875	10,000.00	March 3, 1905	10,000.00
August 14, 1876	10,000.00	Miscellaneous receipts	.42
June 18, 1878	15,000.00		
March 3, 1879	5,000.00	Total	663,435.42
June 14, 1880	8,000.00	Amount carried to surplus fund, 1872	.90
March 3, 1881	10,000.00		
August 3, 1882	12,000.00	Balance	663,434.52
July 5, 1884	10,000.00		
August 5, 1886	56,250.00		

ABSTRACT OF CONTRACTS IN FORCE.

Extension and repair of piers.

Contractor: T. J. Bennett & Co.
Date of contract: November 8, 1902.
Date of approval: November 28, 1902.
Date of beginning: April 15, 1903.
Date of expiration: December 31, 1903. (Time limit waived.)
Rates: Cutting down and removing old work, $2.10 per linear foot; dredging, 50 cents per cubic yard; foundation piles, 60 cents per linear foot; white-oak piles, 33 cents per linear foot; white-oak timber, $48 per M feet B. M.; white-pine timber, $30.90 per M feet B. M.; hemlock timber, $21 per M feet B. M.; long-leaf yellow-pine plank for sheet piles, $38 per M feet B. M.; white-pine plank for decking, $28 per M feet B. M.; driftbolts and spikes, 3 cents per pound; screw bolts, 3½ cents per pound; carriage bolts, 4 cents per pound; tie-rods, 3½ cents per pound; stone, $6.75 per cord; sand filling, 16 cents per cubic yard.

[a] Exclusive of $67,040 expended for dredge to June 30, 1904.
[b] Includes $17,564.33 for dredge.
[c] Includes $305.03 for dredge.

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Dredging.

Contractor: Samuel O. Dixon.
Date of contract: March 25, 1904.
Date of approval: April 15, 1904.
Date of beginning: May 3, 1904.
Date of expiration: September 17, 1904. (Time limit waived.)
Rate: 17½ cents per cubic yard.

COMMERCIAL STATISTICS FOR LUDINGTON HARBOR, MICHIGAN, CALENDAR YEAR ENDING DECEMBER 31, 1904.

[Compiled from statement furnished by the deputy collector of customs at Ludington, Mich.]

Character of vessel.	Number.	Tonnage.
Steam, entered and cleared	3,387	5,090,761
Sail, entered and cleared	169	20,656
Total	3,556	5,111,417

Maximum draft, 18 feet.

Receipts and shipments by vessels, 1904.

Articles received.	Tons.	Articles shipped.	Tons.
Beer	9,518	Bark	1,287
Cement	1,781	Cement	9,835
Coal	2,185	Coal	434,602
Copper	18,538	Flour	77
Flour	129,228	Fruit	1,341
Grain	204,690	Grain	1,045
Iron	6,929	Iron	16,596
Lumber	274,646	Lumber	60,296
Malt	45,177	Malt	207
Potatoes	21	Marble	117
Stone	12,500	Oil	40
Merchandise, miscellaneous	158,796	Potatoes	170
		Salt	66,262
		Stone	1,483
		Wood	1,000
		Wooden ware	456
		Merchandise, miscellaneous	172,908
Total	864,019	Total	767,722

	Tons.
Total freight carried in 1904	1,631,741
Total freight carried in 1903	1,362,858
Increase	268,883

M 11.

IMPROVEMENT OF HARBOR AT MANISTEE, MICHIGAN.

The history of this work to the beginning of the year is found in the Report of the Chief of Engineers for 1904, pages 3021–3023.

OPERATIONS DURING FISCAL YEAR ENDING JUNE 30, 1905.

T. J. Bennett & Co., the contractors for the extension of the south pier by one 150 by 30 by 16½ foot crib on a pile foundation and with a

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superstructure 6 feet high, completed their work on August 3. The operations after July 1 consisted in the building of the superstructure, the securing of the three mooring posts and of the guard timbers at the outer end, the completion of the stone filling, and in putting on the decking.

Repairs by day labor and purchased material were made to the following portions of the north pier, damaged by collision: Station 8+04.7 to station 8+29, damaged by the steamer *Hennepin* November 12, 1903; station 8+43.2 to station 8+77.2, damaged by the steamer *F. W. Fletcher* April 30, 1903; station 14+09.5 to station 14+29.5, damaged by the steamer *N. J. Nessen* September 3, 1903, and station 27+88.1 to station 28+14.4, damaged by the steamer *P. M. No. 4* June 23, 1903. The repairs consisted in cutting out the broken timbers and replacing them by new ones. The cost of repairing *Hennepin* damage has been collected through the United States attorney and deposited; the cost of the other cases has not yet been collected, this matter being in the hands of the United States attorney. One-half the expense of repairing the *Fletcher* damage is to be borne by the United States. Some rotten timbers in the upper courses of the north pier between the stations 9+24.8 and 10+21.4 were replaced by new ones at the same time.

Under the contract with Samuel O. Dixon dredging was begun September 10 and completed October 4, for the improvement of the channel at the entrance and between the piers. Three cuts, each 30 feet wide and 20 feet deep below zero of gauge and varying in length from 180 to 510 feet, were made at the entrance; 3 cuts, of the came cross section and from 355 to 530 feet long, were made between the projecting part of the piers, and one cut, 30 feet wide, 18 feet deep, and 660 feet long, was made opposite the inner part of the south pier. The dredged quantity was 14,513 cubic yards. The dredging resulted in reestablishing an available depth of 18 feet at the zero level for the full width of the channel at the entrance and a depth of 16 feet for a width of 100 feet between the piers. The price per cubic yard was 17½ cents.

By soundings made June 12–15 the following available depths, referred to the level of zero of gauge, were found: Outside on the line of the north pier, 19.4 feet; opposite the middle of the entrance, 19 feet, and on the line of the south pier, 15.8 feet. Between the piers there was 19 feet for a width of 120 feet next to the north pier at the outer end, and 16.5 feet in mid-channel near shore line, and in the river the depth in the channel of best water was 15 feet. The stage of the lake at the time of soundings was +0.2 to — 0.1 foot.

The foregoing operations cost as follows:

Extension of south pier, under contract with T. J. Bennett & Co	$3,762.68
Dredging, under contract with Samuel O. Dixon	2,539.78
Minor repairs to piers	216.05

CONDITION OF WORK JUNE 30, 1905.

The piers and revetments are in fair condition, except that the filling in many pockets has settled considerably, that about 100 feet of the south pier is 21 to 23 years old and will soon need new superstructure, and that the portion of the north pier occupied by the

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Manistee and Northeastern Railroad Company still remains unrepaired.

The condition of the channel is as stated under the head of "Operations."

The Secretary of War, under date of February 11, 1905, approved plans for a bridge to replace the old structure across Manistee River, at Maple street, in the city of Manistee.

WORK PROPOSED FOR THE FISCAL YEAR ENDING JUNE 30, 1906.

By the river and harbor act of March 3, 1905, the amount of $10,000 for maintenance was appropriated. This, together with the balance of previous appropriations, makes the amount available $24,172.49. It is proposed to reserve $1,000 as part payment of an inspection and survey steamer, to apply $10,000 for dredging operations during the seasons of 1905 and 1906 (the work to be done by the *General Gillespie*), to apply $5,000 to pier repairs when they become necessary, and to reserve the balance for emergencies.

The preliminary examination of this harbor, with a view to obtaining a uniform depth of 18 feet, ordered by the act of March 3, 1905, will be made in the near future and report submitted.

ESTIMATE OF FUNDS FOR FISCAL YEAR ENDING JUNE 30, 1907.

The approved project calls for a further extension of the south pier, which will cost $12,000. The estimate for maintenance by repairs and dredging is $15,000, making the total estimate $27,000.

Total amount appropriated and allotted to June 30, 1905		$447,000.00
Miscellaneous receipts		24.87
		447,024.87
Total amount expended on project, 1866, amended 1871, 1875, 1890, 1892, 1898, and 1901:		
For construction	$329,950.64	
For maintenance	92,859.74	
		422,810.38
Balance		24,214.49
Original estimated cost of work, 1866, amended in 1871, 1875, 1890, 1892, 1898, and 1901		428,000.00

Money statement.

July 1, 1904, balance unexpended		$32,280.60
Amount appropriated by river and harbor act approved March 3, 1905		10,000.00
Deposited February 11, 1905		24.87
		42,305.47
June 30, 1905, amount expended during fiscal year:		
For works of improvement	[a] $15,165.21	
For maintenance of improvement	2,925.77	
		18,090.98
July 1, balance unexpended		24,214.49
July 1, 1905, outstanding liabilities		42.00
July 1, 1905, balance available		24,172.49
Amount (estimated) required for completion of existing project		12,000.00

[a] Includes $10,000 for dredge.

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Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$12,000.00	
For maintenance of improvement	15,000.00	
		$27,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

APPROPRIATIONS.

March 2, 1867	$60,000.00	July 5, 1884	$10,000.00
July 11, 1870	20,000.00	August 5, 1886	10,000.00
March 3, 1871	9,000.00	August 11, 1888	10,000.00
June 10, 1872	10,000.00	September 19, 1890	50,000.00
March 3, 1873	10,000.00	July 13, 1892	50,000.00
June 23, 1874	10,000.00	August 18, 1894	12,000.00
March 3, 1875	25,000.00	June 3, 1896	15,000.00
August 14, 1876	14,000.00	March 3, 1899	20,000.00
June 18, 1878	15,000.00	June 13, 1902	42,000.00
March 3, 1879	10,000.00	March 3, 1905	10,000.00
June 14, 1880	10,000.00	Miscellaneous receipts	24.87
March 3, 1881	10,000.00		
August 2, 1882	15,000.00	Total	447,024.87

ABSTRACT OF CONTRACTS IN FORCE.

Extension of south pier.

Contractor: T. J. Bennett & Co.
Date of contract: November 14, 1902.
Date of approval: December 4, 1902.
Date of beginning: April 15, 1903.
Date of expiration: November 1, 1903. (Time limit waived.)
Rate: Dredging, 40 cents per cubic yard; foundation piles, 50 cents per linear foot; white-oak guard piles, 34 cents per linear foot; white-oak timber, $48 per M feet B. M.; white-pine timber, $30.90 per M feet B. M.; hemlock or Norway pine timber, $21 per M feet B. M.; white-pine plank, $27 per M feet B. M.; drift-bolts, screw bolts, and spikes, 3 cents per pound; stone, $6.25 per cord.

Dredging.

Contractor: Samuel O. Dixon.
Date of contract: March 25, 1904.
Date of approval: April 15, 1904.
Date of beginning: May 3, 1904.
Date of expiration: September 17, 1904. (Time limit waived.)
Rate: 17½ cents per cubic yard.

COMMERCIAL STATISTICS FOR MANISTEE HARBOR, MICHIGAN, CALENDAR YEAR ENDING DECEMBER, 31, 1904.

[Compiled from statement furnished by the deputy collector of customs at Manistee, Mich.]

Character of vessel.	Number.	Tonnage.
Steam, entered and cleared	1,490	284,649
Sail, entered and cleared	230	71,162
Total	1,720	355,811

Maximum draft, 15 feet.

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Receipts and shipments by vessel, 1904.

Articles received.	Tons.	Articles shipped.	Tons.
Brick	87	Bark	7,905
Cattle	10	Lumber	148,678
Coal	1,670	Salt	249,463
Gravel	110	Shingles	319,212
Hay	150	Wood	4,020
Lumber	4,658	Merchandise, miscellaneous	4,106
Stone	41,000		
Merchandise, miscellaneous	12,754		
Total	60,439	Total	733,384

	Tons.
Total freight carried in 1904	793,823
Total freight carried in 1903	570,361
Increase	223,462

M M 12.

HARBOR OF REFUGE AT PORTAGE LAKE, MANISTEE COUNTY, MICHIGAN.

The history of this improvement to the beginning of the year is found in the report of the Chief of Engineers for 1904, pages 3025–3026.

OPERATIONS DURING FISCAL YEAR ENDING JUNE 30, 1905.

The repairs of the south pier between its east end and station 7+71, work on which was begun in May, 1904, were completed by contractors T. J. Bennett & Co. on October 7. The repairs consisted in cutting down the old work to the level of zero of gauge, making the front wall sand-tight by means of triple sheet piles supported by round piles and strengthened by a front wale and iron tie-rods, and building a new superstructure 4 feet high in the front wall and 2 feet high in the rear wall. The following is a detailed statement of the operations after July 1. The number of triple sheet piles driven was 686 in the front wall, extending over a distance of 697.3 feet, and 14 in the cross wall at the east end, the length of upper binder put in place was 701.3 feet, and of lower binder, 787.8 feet. The number of new front piles driven was 126, the length of front wale was 792.4 feet, and the number of tie-rods 88. The length of the new superstructure in the front wall from station 7+71 to the end of the wing at the east end of the pier is 791.2 feet. A plank walk 3 feet wide was built on top of the work. The cost of operations during year was $12,124.82.

Soundings were made June 17–19, showing the following available depths for a stage of zero gauge: Outside, 19.7 feet on line of north pier, 17.5 feet opposite the middle of entrance, and 20.1 feet on the line of the south pier. Between the piers there was 19.6 feet in mid-channel at the outer end, and 18 feet for a width of 80 feet in mid-channel at shore line. The stage of the lake at the time of sounding was +0.1 to —0.1 foot.

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CONDITION OF WORK JUNE 30, 1905.

The piers and revetments are in good condition. The condition of the channel is as stated under the head of "Operations." At the shore line the width of the 18-foot channel, which was dredged 180 feet wide in 1903–4, is reduced to 80 feet. This shoaling is no doubt caused principally by the leveling action of the waves on the banks left on each side of the dredged channel.

WORK PROPOSED FOR FISCAL YEAR ENDING JUNE 30, 1906.

No appropriation was made for this harbor in the river and harbor act of March 3, 1905, and the available funds are restricted to the balance remaining from previous appropriations. Of this balance $500 is to be used in part payment of an inspection and survey steamer, and the remainder will be reserved for incidental repairs.

ESTIMATE OF FUNDS FOR FISCAL YEAR ENDING JUNE 30, 1907.

The pier constructions called for by the approved project are completed. For the proper maintenance of the channel it will be necessary to reduce the high banks which remain between it and the piers. This will require the removal of an estimated quantity of 100,000 cubic yards, at a cost of $17,500. The estimate for ordinary repairs is $5,000, making the total estimate for maintenance $22,500.

Total amount appropriated and allotted to June 30, 1905		$369,500.00
Total amount expended on project of 1879, amended in 1890, 1898, and 1899:		
For construction	$254,129.21	
For maintenance	110,387.42	
		364,516.63
Balance		4,983.37
Original estimated cost of work, 1879, amended in 1890, 1898, and 1899		344,300.00

Money statement.

July 1, 1904, balance unexpended		$31,279.02
June 30, 1905, amount expended during fiscal year:		
For works of improvement	[a]$10,000.00	
For maintenance of improvement	16,295.65	
		26,295.65
July 1, 1905, balance unexpended		4,983.37
July 1, 1905, outstanding liabilities		20.50
July 1, 1905, balance available		4,962.87
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905		22,500.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

[a] For dredge.

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APPROPRIATIONS.

March 3, 1879	$10,000	August 18, 1894	$25,000
June 14, 1880	10,000	June 3, 1896	25,000
March 3, 1881	10,000	March 3, 1899	75,000
August 2, 1882	25,000	June 6, 1900	85,000
July 5, 1884	12,500	June 13, 1902	59,000
August 5, 1886	15,000		
August 11, 1888	10,000	Total	369,500
September 19, 1890	8,000		

ABSTRACT OF CONTRACTS IN FORCE.

Repair of south pier.

Contractor: T. J. Bennett & Co.
Date of contract: April 17, 1903.
Date of approval: May 13, 1903.
Date of beginning: Not earlier than April 1 nor later than May 1, 1904.
Date of expiration: Five months from date of beginning and not later than October 1, 1904. (Time limit waived.)
Rates: Cutting down and removing old work, $1 per linear foot; white-oak piles, 33 cents per linear foot; white-oak timber, $45 per M feet B. M.; white pine, longleaf yellow pine, or Douglas-fir timber, $32 per M feet B. M.; white pine, longleaf yellow pine, or Douglas-fir planks for sheet piles, $40 per M feet B. M.; white pine or longleaf yellow-pine planks for decking, $30 per M feet B. M.; driftbolts, 3¼ cents per pound; screw bolts, tie-rods, and spikes, 3½ cents per pound; carriage bolts, 4½ cents per pound.

M M 13.

IMPROVEMENT OF HARBOR AT ARCADIA, MICHIGAN.

This harbor, as far as it is proposed to be improved by the United States, is the channel leading from Lake Michigan to Bar Lake, at the north end of which is situated the village of Arcadia. It is about 9 miles north of Portage Lake Harbor and 11 miles south of Frankfort Harbor. It is an artificial channel between parallel piers created and maintained by private enterprise. The river and harbor act of March 3, 1899, ordered a preliminary examination to be made, with a view to obtaining a channel 150 feet wide and 14 feet deep, and under date of August 22, 1899, Capt. Chester Harding, Corps of Engineers, submitted a report of the results of the examination. This report is printed on pages 3942–3946 of the Annual Report of the Chief of Engineers for 1900.

In pursuance of a requirement of the river and harbor act of June 13, 1902, Capt. Charles Keller, Corps of Engineers, submitted a report, dated October 29, 1902, on survey of Arcadia Harbor, with estimate of cost of maintaining piers and channel. This report was published in House Document No. 194, Fifty-eighth Congress, second session, and is printed in the Annual Report of the Chief of Engineers for 1904, pages 3037–3048. Captain Keller presented a plan for thoroughly rebuilding the piers at an estimated cost of $90,390, and $5,200 annually for maintaining the piers and dredging the channel, but, for reasons stated, reported that in his judgment this expenditure was not justifiable, but that the locality was worthy of improvement to the extent of maintaining the existing channel by dredging

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only, at a cost of $3,000 annually for a period of five years. By special report of November 11, 1902, Captain Keller defined such a channel to have a minimum depth of 12 feet, referred to the zero of the engineer gauge, and a width of not less than 50 feet. The report was concurred in by the Chief of Engineers, and the river and harbor act of March 3, 1905, adopted the project of improving the harbor at Arcadia by appropriating $6,000, to be expended in accordance with it.

It is therefore proposed to dredge the channel between the piers during the years of 1905 and 1906, at a cost of $3,000, including contingencies, each year. The contract, entered into with the Chicago and Great Lakes Dredge and Dock Company on April 29, provides for the work to be done in 1905, and it is expected that the dredge will arrive at the harbor early in August. The work in 1906 will be done either by Government plant or by contract, as may be most advantageous at the time.

Soundings were made June 21–23, showing the following available depths referred to the level of zero of gauge: Outside the line of the south pier, 11.8 feet; between the piers there was 9 feet on line parallel to and 60 feet from the south pier. The stage of the lake at the time of sounding was +0.1 foot.

The estimate of funds required for fiscal year ending June 30, 1907, is $3,000, for dredging to a 12-foot depth at zero stage, for the maintenance of channel.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1905	$6,000.00
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	48.75
July 1, 1905, balance unexpended	5,951.25
July 1, 1905, outstanding liabilities	14.50
July 1, 1905, balance available	5,936.75
July 1, 1905, amount covered by uncompleted contracts	2,700.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	3,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATION.

March 3, 1905	$6,000

ABSTRACT OF CONTRACTS IN FORCE.

Dredging.

Contractor: Chicago and Great Lakes Dredge and Dock Company.
Date of contract: April 29, 1905.
Date of approval: May 9, 1905.
Date of beginning: May 27, 1905.
Date of expiration: September 12, 1905.
Rate: 17¼ cents per cubic yard.

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COMMERCIAL STATISTICS.

No data for calendar year ending December 31, 1904, could be obtained; therefore, under this head, reference can only be made to the statements on pages 3046–3047, Annual Report for 1904, which cover the period from 1894 to 1901, inclusive.

M M 14.

IMPROVEMENT OF FRANKFORT HARBOR, MICHIGAN.

The history of this work to the beginning of the year is found in the Report of the Chief of Engineers for 1904, pages 3028–3029.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1905.

Dredging operations under contract with Samuel O. Dixon were begun August 29 and completed September 12, and resulted in restoring a depth of 19 feet below zero of gauge for the full width of the channel at and outside of the end of the piers. The dredged quantity was 8,008 cubic yards; price per yard, 17½ cents; cost, $1,401.40.

On June 24–27 the available depths, referred to zero of gauge, were as follows: Outside, 19.7 feet on line of north pier; 18.2 feet on a line 70 feet south and 20.6 feet on a line 140 feet south of the line of the north pier, and 18.7 feet on line of south pier. Between the piers there was 20.8 feet in mid-channel at the outer end, and thence to the inner lake 18 feet for a width of 120 feet. The stage of the lake at time of sounding was +0.1 to —0.1 foot.

By letter of September 27 the Frankfort Hotel Company notified the Secretary of War that it had discontinued and would not again use the privilege granted under date of September 5, 1903, to occupy the north pier between the inner end and station 8.

CONDITION OF WORK JUNE 30, 1905.

In the north pier the first 300 feet at the inner end have been badly damaged in the upper two courses by the steamers of the Ann Arbor Railroad Company, and the top course between station 16+67 and station 16+97 has been broken by some unknown vessel. With these exceptions the pier is in good condition. In the south pier the pile work at the inner end, station 0 to station 1+86, has been practically destroyed by the railroad steamers. The front wall between station 0 and station 0+60 is entirely gone, and the remainder hangs over into the channel and must be removed. With this exception the pier is in fair condition.

The condition of the channel is as described under the head of "Operations."

WORK PROPOSED FOR FISCAL YEAR ENDING JUNE 30, 1906.

By the river and harbor act of March 3, 1905, there was appropriated for continuing improvement and for maintenance $20,000. This amount, together with the balance remaining on hand from previous

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appropriations, it is proposed to apply as follows: $5,000 will be used to put the piers in serviceable condition by repairing the damaged or defective portions. The cost of the repairs of the parts damaged by the steamers of the Ann Arbor Railroad Company will, in part, be refunded by that company. There will be $10,000 applied to dredging at and beyond the harbor entrance by the U. S. dredge *General Gillespie*, and the remainder of the funds will be reserved for dredging next season and for incidental repairs.

ESTIMATE OF FUNDS FOR FISCAL YEAR ENDING JUNE 30, 1907.

The approved project requires an addition of 100 feet to each pier, the estimate for which is $22,000. The appropriation of this amount should, however, be made somewhat contingent on the inquiries of the Board of Engineers into the effect of wave action as injuriously affecting the harbors at Ludington and elsewhere, inasmuch as this extension of piers on present lines may not be regarded as the best plan of improvement.

The maintenance of the channel by dredging is estimated to require $10,000, and $5,000 should be provided for incidental repairs.

The total estimate is therefore as follows:

For construction		$22,000
For maintenance		15,000
Total		37,000
Total amount appropriated and allotted to June 30, 1905		458,159.85
Less amount covered into Treasury		5,721.50
		452,438.35
Total amount expended on project, 1866, amended in 1868, 1879, 1892, 1898, and 1899:		
For construction	$321,459.02	
For maintenance	102,819.42	
		424,278.44
Balance		28,159.91
Original estimated cost of work, 1866, amended 1868, 1879, 1892, 1898, and 1899		421,938.35

Money statement.

July 1, 1904, balance unexpended		$20,237.45
Amount appropriated by river and harbor act approved March 3, 1905		20,000.00
		40,237.45
June 30, 1905, amount expended during fiscal year:		
For works of improvement	[a]$10,000.00	
For maintenance of improvement	2,077.54	
		12,077.54
July 1, 1905, balance unexpended		28,159.91
July 1, 1905, outstanding liabilities		20.00
July 1, 1905, balance available		28,139.91
Amount (estimated) required for completion of existing project		22,000.00

[a] For dredge.

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Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:

For works of improvement	$22,000.00	
For maintenance of improvement	15,000.00	
		$37,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

APPROPRIATIONS.

Aux Becs Scies, Michigan:	
June 23, 1866	$88,541.00
March 2, 1867	10,000.00
July 25, 1868 (allotment)	10,000.00
April 10, 1869 (allotment)	29,318.85
July 11, 1870	10,000.00
March 3, 1871	10,000.00
Frankfort, Mich.:	
June 10, 1872	10,000.00
March 3, 1873	10,000.00
June 23, 1874	10,000.00
March 3, 1875	10,000.00
August 14, 1876	3,000.00
June 18, 1878	8,800.00
March 3, 1879	4,000.00
June 14, 1880	5,000.00
March 3, 1881	10,000.00
Frankfort, Mich.—Cont'd.	
August 2, 1882	$15,000.00
July 5, 1884	5,000.00
August 5, 1886	7,000.00
August 11, 1888	8,000.00
September 19, 1890	10,000.00
July 13, 1892	10,000.00
August 18, 1894	50,000.00
June 3, 1896	15,000.00
March 3, 1899	35,000.00
June 13, 1902	54,500.00
March 3, 1905	20,000.00
Total	458,159.85
Amount covered into the Treasury (Report, 1871, p. 133)	5,721.50
Balance	452,438.35

ABSTRACT OF CONTRACTS IN FORCE.

Dredging.

Contractor: Samuel O. Dixon.
Date of contract: March 25, 1904.
Date of approval: April 15, 1904.
Date of beginning: May 3, 1904.
Date of expiration: September 17, 1904. (Time limit waived.)
Rate: 17½ cents per cubic yard.

COMMERCIAL STATISTICS FOR FRANKFORT HARBOR, MICHIGAN, CALENDAR YEAR ENDING DECEMBER 31, 1904.

[Compiled from statement furnished by the deputy collector of customs at Frankfort, Mich.]

Character of vessel.	Number.	Tonnage.
Steam, entered and cleared	1,659	1,608,302
Sail, entered and cleared	233	14,786
Total	1,892	1,618,088

Maximum draft, 18 feet.

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Receipts and shipments by vessel, 1904.

Articles received.	Tons.	Articles shipped.	Tons.
Feed	51	Bark	40
Freight cars:		Cedar posts	30
Loaded	445,690	Freight cars:	
Empty	2,805	Loaded	420,980
Hay	350	Empty	390
Oats	62	Lumber	13,085
Shingles	15	Poles	1,610
Merchandise, miscellaneous	6	Sawdust	300
		Slabs	6,238
		Wood, etc	1,928
Total	448,988	Total	444,809

	Tons.
Total freight carried in 1903	948,857
Total freight carried in 1904	893,857
Decrease	55,030

M M 15.

IMPROVEMENT OF HARBOR AT CHARLEVOIX, MICHIGAN.

The history of this work to the beginning of the year is found in the Report of the Chief of Engineers for 1904, pages 3031–3033.

OPERATIONS DURING FISCAL YEAR ENDING JUNE 30, 1905.

Repairs were made in September to the outer end of the south pier, which had been damaged May 15, 1904, by the steamer *Three Brothers*, by cutting out the broken timbers and rebuilding the work. The cost of the repairs, $119.65, was collected from the owners of the steamer through the United States district attorney and deposited to the credit of the appropriation.

In November the empty pockets at the end of the south pier were refilled with 12.8 cords stone, under a special agreement with A. J. Beauvais & Co., the cost being $76.80.

Soundings were made June 29–July 1, 1905, and the following available depths, referred to zero of gauge, were found: In the lower channel, 16 feet outside opposite the middle of the entrance, and the same depth for a width of 80 feet between the piers at the outer end, and for a width of 40 feet farther inside; in the upper channel, a depth of 16 feet for a width of 60 feet. The stage of the lake at the time of sounding was 0.0 to —0.1.

CONDITION OF WORK JUNE 30, 1905.

In the lower channel the north revetment from station 0 to station 9+45 is a complete wreck. The interior portion, 345 feet in length, has been used by the owners of the land behind it as a landing for vessels and for purposes of transshipping freight, and it should be repaired by them at their expense. From station 9+45 to the outer end the pier is in good condition. In the south pier the 300 feet at the east end is badly damaged by colliding vessels, but the remainder

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is in good condition. In the upper channel the north revetment has been repaired and is in good condition, but needs some additional stone ballast. The south revetment is in bad condition.

The condition of the channels is as stated under the head of "Operations."

WORK PROPOSED FOR FISCAL YEAR ENDING JUNE 30, 1906.

By the act of March 3, 1905, the amount of $25,000 was appropriated for continuing improvement and for maintenance. Of this amount it is proposed to apply about $18,000 to the repairs of 600 feet of the north revetment of the lower channel and to the repairs of the south revetment of the upper channel, and for additional stone in the north revetment. The plans and specifications are nearly ready, and bids for the work will be invited in the near future. The remainder of the funds will be applied to immediate repairs and to the maintenance of the usual channel depths, the dredging to be done by the U. S. dredge *General Gillespie*, when available for the work.

ESTIMATE OF FUNDS FOR FISCAL YEAR ENDING JUNE 30, 1907.

The approved project provides for an extension of 200 feet to the south pier, at an estimated cost of $19,800. For maintenance $5,000 is asked for general repairs and $5,000 for dredging, making a total of $29,800.

Total amount appropriated and allotted to June 30, 1905		$200,500.00
Miscellaneous receipts		119.65
		200,619.65
Total amount expended on project, 1868, amended in 1876 and 1884:		
For construction	$80,205.04	
For maintenance	95,518.25	
		175,723.29
Balance		24,896.36
Original estimated cost, 1868, amended 1876 and 1884		184,000.00

Money statement.

July 1, 1904, balance unexpended	$2,083.05
Amount appropriated by river and harbor act approved March 3, 1905	25,000.00
Deposited March 27, 1905	119.65
	27,202.70
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	[a] 2,306.34
July 1, 1905, balance unexpended	24,896.36
July 1, 1905, outstanding liabilities	56.00
July 1, 1905, balance available	24,840.36
Amount (estimated) required for completion of existing project	19,800.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:	
For works of improvement	$19,800.00
For maintenance of improvement	10,000.00
	29,800.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

[a] Includes $500 for dredge.

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APPROPRIATIONS.

August 14, 1876	$10,000.00	July 13, 1892	$10,000.00
June 18, 1878	12,000.00	August 18, 1894	8,000.00
March 3, 1879	9,000.00	June 3, 1896	20,000.00
June 14, 1880	10,000.00	March 3, 1899	15,000.00
March 3, 1881	10,000.00	June 13, 1902	20,000.00
August 2, 1882	10,000.00	March 3, 1905	25,000.00
July 5, 1884	10,000.00	Miscellaneous receipts	119.65
August 5, 1886	10,000.00		
August 11, 1888	12,500.00	Total	200,619.65
September 19, 1890	9,000.00		

COMMERCIAL STATISTICS FOR CHARLEVOIX HARBOR, MICHIGAN, CALENDAR YEAR ENDING DECEMBER 31, 1904.

[Compiled from statement furnished by the deputy collector of customs at Charlevoix, Mich.]

Steam and sail vessels, entered and cleared:	
Number	354
Tonnage	170,223
Maximum draft, feet	16.3

Receipts and shipments, by vessel, 1904.

Articles received.	Tons.	Articles shipped.	Tons.
Angle bars	35	Lumber, slabs, shingles, etc	103,615
Apples	3	Potatoes	600
Cattle	75	Merchandise, miscellaneous	1,044
Grain	1,098		
Ore	5,650		
Rails	60		
Stone	625		
Merchandise, miscellaneous	569		
Total	8,117	Total	105,259

	Tons.
Total freight carried in 1903	117,586
Total freight carried in 1904	113,376
Decrease	4,210

M M 16.

IMPROVEMENT OF HARBOR AT PETOSKEY, MICHIGAN.

The history of this improvement to the beginning of the year is found in the Report of the Chief of Engineers for 1904, pages 3035–3036.

OPERATIONS DURING FISCAL YEAR ENDING JUNE 30, 1905.

A contract was entered into on July 2, 1903, with A. J. Beauvais & Co. for removing the north breakwater and extending the west breakwater 300 feet, the extension to consist of the two cribs removed from the north breakwater and of one new crib 100 feet long, 30 feet wide, and 22½ feet high, resting on a stone foundation, and provided with a continuous superstructure 3 and 4 feet high, the work to begin

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May 1 and to be completed November 1, 1904. Actual operations were begun June 13, 1904, and were continued until the beginning of November, when they were suspended for the winter. The time limit having been waived, operations were resumed May 17 and have been prosecuted since then. The work done during the fiscal year is as follows: 143.9 cords large stone and 479.7 cords small stone were raised from the cribs and the foundation of the north breakwater, and of these 143.9 cords large stone and 380.2 cords small stone have been deposited in the foundation of the proposed extension of the west breakwater. The north breakwater crib No. 1 was raised on September 23, and, the foundation having been completed, the crib was sunk in its new position in the west breakwater on September 27, with the insufficient quantity of 112.7 cords stone. The storm of September 29 displaced the crib from its foundation, and during the subsequent stormy weather it moved to about midway between the end of the west breakwater and the landing pier, whence it was removed by the contractors and placed under the shelter of the west breakwater. The pounding of the crib on the bottom during this time seriously damaged the lower six courses, necessitating extensive repairs, and in June the crib was turned over and the damaged portions were rebuilt. The three upper courses of the crib were seriously injured by colliding vessels and must also be repaired. Eighteen courses of the new crib, intended for the end of the extension, have been completed. The cost of operations during year was $1,275.95.

CONDITION OF WORK JUNE 30, 1905.

Upon the completion of the work now in progress under contract with A. J. Beauvais & Co., the works at this harbor will consist of a westerly breakwater about 901 feet long, consisting of 200 feet of stonework and 701 feet of cribwork. A break now existing in the lake wall of the present end crib will be closed up under the contract now in force. When the work above mentioned is completed, the breakwater will be in good condition.

WORK PROPOSED FOR THE FISCAL YEAR ENDING JUNE 30, 1906.

The work under the contract with A. J. Beauvais & Co. will be completed.

By the act of March 3, 1905, $20,000 were appropriated for continuing the improvement and for maintenance. Of this it is proposed to apply $15,000 to further extension of the breakwater by one crib 100 feet long, the work to be done by contract, and to reserve the balance for incidental repairs and contingencies. Plans and specifications for the new crib have been submitted for approval, and bids for the work will be invited by public advertisement in the near future.

ESTIMATE OF FUNDS FOR FISCAL YEAR ENDING JUNE 30, 1907.

A further extension of the west breakwater will unquestionably prove necessary after the completion of the removal of the north breakwater. An estimate is therefore furnished for an extension of 200 feet, at $30,000, and for maintenance, $3,000; total, $33,000.

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Total amount appropriated to June 30, 1905		$108,000.00
Total amount expended to June 30, 1905, on project of 1894, amended in 1902:		
For construction	$57,621.63	
For maintenance	2,378.68	
		60,000.31
Balance		47,999.69
Original estimated cost of work, 1894		170,000.00

Money statement.

July 1, 1904, balance unexpended	$32,420.22
Amount appropriated by river and harbor act approved March 3, 1905	20,000.00
	52,420.22
June 30, 1905, amount expended during fiscal year, for works of improvement	4,420.53
July 1, 1905, balance unexpended	47,999.69
July 1, 1905, outstanding liabilities	135.00
July 1, 1905, balance available	47,864.69
July 1, 1905, amount covered by uncompleted contracts	25,974.70
Amount (estimated) required for completion of existing project	62,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:	
For works of improvement	$30,000.00
For maintenance of improvement	3,000.00
	33,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

APPROPRIATIONS.

September 19, 1890	$15,000	June 13, 1902	$15,000
July 13, 1892	20,000	March 3, 1905	20,000
August 18, 1894	10,000		
June 3, 1896	8,000	Total	108,000
March 3, 1899	20,000		

ABSTRACT OF CONTRACTS IN FORCE.

Extension of west breakwater.

Contractors: A. J. Beauvais & Co.
Date of contract: July 2, 1903.
Date of approval: July 28, 1903.
Date of beginning: Any time prior to May 1, 1904.
Date of expiration: November 1, 1904. (Time limit waived.)
Rates: Removing north breakwater cribs and stone filling and replacing same in west breakwater, lump sum of $8,250; white-oak timber, $60 per M; white pine, longleaf yellow-pine, or Douglas-fir timber, $35 per M; white-pine or longleaf yellow-pine timber for deck, $34 per M; hemlock or Norway pine timber, $28.50 per M; driftbolts and screw bolts, 4 cents per pound; spikes, 5 cents per pound; stone, $6.50 per cord.

COMMERCIAL STATISTICS.

No data relative to commercial statistics could be obtained.

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M M 17.

ESTABLISHMENT OF HARBOR LINES IN GRAND RIVER AT GRAND RAPIDS, MICHIGAN.

UNITED STATES ENGINEER OFFICE,
Grand Rapids, Mich., November 9, 1904.

GENERAL: I have the honor to report that the common council of the city of Grand Rapids, Mich., passed a resolution September 19, 1904, directing the city clerk to request the United States Government, through this office, to establish harbor lines along the banks of Grand River from Fulton street south to Wealthy avenue and as much farther as may be considered necessary at this time, and that the city clerk notified me of this action on September 22, 1904.

In compliance with this request a map,[a] like the copy herewith, was prepared on which the harbor lines that are recommended for adoption are indicated in red lines, and this map was shown to the city council and to interested parties who are owners of property bordering on the proposed harbor lines, and it may be said that the positions of the lines indicated in red would be acceptable, as far as the Grand Rapids interests are concerned.

For the purpose of authoritatively adopting these or some other approved lines, I have the honor to request such action in the premises as may be deemed proper.

Very respectfully, your obedient servant,

M. B. ADAMS,
Colonel, Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

[First indorsement.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, November 5, 1904.

Respectfully returned to Colonel Adams.

By section 11 of the river and harbor act of March 3, 1899, the Secretary of War is empowered to establish harbor lines only in cases where it is made manifest to him that such action is essential to the preservation and protection of harbors.

If this necessity can be shown, as required by law, the lines determined upon as the best compromise between conflicting interests will be recommended for approval to the Secretary of War. There is, however, no showing to that effect in Colonel Adams's letter.

The lines laid down upon the accompanying blueprint[a] are not sufficiently definite for final action. Each line must be accurately described by the azimuth and length of its various courses and referred at intervals to fixed points on shore which can be readily identified for future use. In case no such fixed points can be found permanent monuments should be placed.

It also appears that the present case is important enough to warrant holding a public hearing, at which the lines tentatively laid

[a] Not printed.

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down on the map may be exhibited and fully discussed by parties in interest. It is particularly necessary that those riparian owners whose water front is cut off by the proposed lines—as, for instance, the front along the city market and adjacent property—should consent to such a disposition which works to deprive them of the right to build docks, wharves, etc., without excavating the land on the river side of the lines.

Establishing the lines will also legalize any fill behind them, so far as this can be done by the United States.

As they are drawn, it would therefore permit filling the old east channel, which would probably give rise to protest.

To be returned.

By command of Brig. Gen. Mackenzie:

H. F. HODGES,
Major, Corps of Engineers.

[Second indorsement.]

U. S. ENGINEER OFFICE,
Grand Rapids, Mich., November 18, 1904.

Respectfully returned to the Chief of Engineers, United States Army.

The accompanying map[a] shows, in addition to proposed harbor lines, the limits of proposed dredging operations between Fulton street and Wealthy Avenue Bridge, and the necessity for establishing harbor lines in the near future may be said to arise from a desire to confine the dredging to proper limits and to dispose of the dredged material in the most advantageous manner.

The fact is appreciated that whatever harbor lines are adopted they must be well defined and permanently marked, and in this connection it may be observed that the lines shown on the map have bridge piers at six of their termini, including the east pier of the Wealthy Avenue Bridge, which pier is to be changed in location so as to be built about where the harbor line is shown.

To facilitate matters in the event of a Board of Engineer officers being appointed to locate harbor lines at Grand Rapids, and from the circumstances that the common council of the city acted as stated within and control the city's interests at the market and Wealthy Avenue Bridge, it seems judicious to take matters up with the city council and other interested parties, so as to be satisfied there would be no opposition to the adoption of lines as shown, should it be decided that they are well located for the interests of the Government.

The filling of the old east channel is taking place all the time and is desired by the owners of abutting property. By withdrawing the east abutment of the Wealthy Avenue Bridge to about where the harbor line is shown, the extreme lower end of the old channel will be saved in the interests of navigation.

M. B. ADAMS,
Colonel, Corps of Engineers.

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[a] Not printed.

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[Third indorsement.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, November 22, 1904.

Respectfully returned to Colonel Adams.

It was understood from paragraph 2 within that Colonel Adams recommended for adoption the lines shown on the accompanying map.[a] Regarding them, however, as merely tentative, Colonel Adams is authorized to hold a public hearing to determine, in the manner indicated in paragraph 5 of the first indorsement, what definite lines to recommend, provided that any such lines shall prove to be essential to the preservation and protection of the harbor. No showing to this effect has yet been made to this office, and without such showing no recommendation for the establishment of lines can be made to the Secretary of War.

To be returned.

By command of Brig. Gen. Mackenzie:

H. F. HODGES,
Major, Corps of Engineers.

[Fourth indorsement.]

U. S. ENGINEER OFFICE,
Grand Rapids, Mich., November 25, 1904.

Respectfully returned to the Chief of Engineers, United States Army.

Paragraph 2 of the third indorsement above appears to authorize me to hold a public hearing for the purpose of establishing harbor lines at Grand Rapids, Mich., in case it can be shown that such lines are essential to the preservation and protection of the harbor.

Paragraph 2 of the second indorsement and paragraph 1 of the within letter were intended to show that such harbor lines are essential, as indicated, in connection with further dredging operations.

The accompanying blueprint[a] shows where dredging operations are proposed for the coming season, and the report of the Board of Engineers for Rivers and Harbors, November 11, 1903, page 3005, Annual Report of the Chief of Engineers for 1904, mentions the great difficulty of disposing of 370,000 cubic yards dredged material from this location and estimates the cost accordingly; therefore, that some provision in the nature of bordering limits between the city's interests, the interests of private owners, and the navigation interests, i. e., the Government's interests, in connection with the proposed dredging operations would seem to constitute an essential feature of the undertaking.

M. B. ADAMS,
Colonel, Corps of Engineers.

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[a] Not printed.

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[Fifth indorsement.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, November 30, 1904.

Respectfully returned to Colonel Adams for action in accordance with first and third indorsements hereon.

After Colonel Adams has decided upon and recommended the lines considered most suitable to all interests, the case will be laid before the Secretary of War by the Chief of Engineers.

To be returned.

By command of Brig. Gen. Mackenzie:

H. F. HODGES,
Major, Corps of Engineers.

[Sixth indorsement.]

U. S. ENGINEER OFFICE,
Grand Rapids, Mich., February 24, 1905.

Respectfully returned to the Chief of Engineers, United States Army, inviting attention to report of this date.

M. B. ADAMS,
Colonel, Corps of Engineers.

[Ninth indorsement.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, April 24, 1905.

Respectfully submitted to the Secretary of War.

Request is made by the common council of the city of Grand Rapids, Mich., for the establishment of harbor lines along Grand River at that place.

The matter is presented through the district engineer officer. Colonel Adams, in whose opinion such lines are essential to the preservation and protection of the river channel in connection with further dredging operations there.

A public hearing has been held at Grand Rapids, at which the lines proposed were exhibited and discussed. So far as known, these lines have been accepted by all property owners interested, without exception.

Concurring in the views of the local officer, I recommend that this application be granted and that the lines presented by Colonel Adams, which are delineated and described on the accompanying tracing,[a] be approved.

The tracing has been prepared for signature.

A. MACKENZIE,
Brig. Gen., Chief of Engineers, U. S. Army.

NOTE.—The lines referred to above and shown on the map mentioned were approved by the Assistant Secretary of War April 28, 1905, the approval being indicated on the map.

[a] Not printed.

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REPORT OF COL. M. B. ADAMS, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Grand Rapids, Mich., February 24, 1905.

GENERAL: In compliance with your instructions conveyed by indorsements on a letter dated November 9, 1904, I have the honor to state that public notice was given January 15, 1905, of a public hearing to be held at this office February 15, 1905, for the purpose of establishing harbor lines in Grand Rapids Harbor, Michigan, and that separate notices were mailed to the various property owners who are interested in the subject by reason of their owning property that borders on the harbor lines proposed for adoption.

One or two property owners communicated with this office by mail, in reply to their notices. Some visited the office separately and inspected the harbor lines proposed, and there were about twenty of such owners who were present at the hearing to express their views on the subject of the lines then under consideration and now recommended for adoption, inasmuch as said lines have been accepted by all the property owners, without a known exception, and meet the ends in view.

The lines that were under consideration at the hearing had been carefully surveyed and platted, as shown on the accompanying map.[a] and may be described as follows:

ON LEFT BANK.

Commencing at a point on the left bank of Grand River within the city of Grand Rapids, Mich., about 275 feet below the mouth of Prescott street sewer, said point being a permanent iron monument marking what is known as stadia station 4 of the Grand River survey, and running thence along the left bank of the river N. 57° 15′ E., 278.8 feet, to station A (a cross "+" cut in the top surface of a granite bowlder which forms a part of the riprap near the mouth of the aforesaid Prescott street sewer); thence N. 52° 16′ E., 1,681.9 feet, to station B (an iron monument in line with the east face of Grand Rapids Felt Boot Works factory); thence N. 48° 52′ 50″ E., 462.35 feet, to station N (an iron monument 75 feet south of the center line of Wealthy Avenue Bridge, and near its eastern extremity); thence N. 3° 32′ 50″ E., 94.05 feet, to station P (the northwest corner of the east abutment of reenforced concrete arch at the east end of the Wealthy Avenue Bridge); thence N. 27° 48′ E., 612.6 feet, to station C (a cross "+" cut in the top surface of the east abutment of the draw of the Pere Marquette Railroad bridge, on center line of track and 3.1 feet north of south face of coping of abutment); thence N. 26° 25′ 49″ E., 559 feet, to station D (an iron monument in the rear of the city lighting station, in line with the southwest face of same and 20 feet from the brickwork of the west corner); thence N. 33° 40′ 50″ E., 1,846.1 feet, to station E, on Fulton Street Bridge (a cross "+" cut in the top surface of a steel floor beam 2 feet south of the south side of the fifth strut in the south truss from the east end of east span; auger hole in sidewalk over point).

ON RIGHT BANK.

Commencing at a point near the west end of Fulton Street Bridge, right bank of Grand River, known as station F (a cross "+" cut in the top surface of a steel floor beam 2 feet south of the south side of the second strut in the south

[a] Not printed.

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truss from the west end of the west span, which bears N. 88° 10′ 30″ W., 405.5 feet from station E), and running thence S. 34° 53′ 10″ W., 1,998.3 feet to station G (a cross "+" cut in the top surface of the third steel floor beam from north end of Pere Marquette Railroad bridge on center line of track and bridge); thence S. 21° 03′ 03″ W., 577.1 feet to station H (a cross "+" cut in top surface of a concrete retaining wall in rear of Edgar S. Kiefer's tannery, point at first angle in wall south of shore line); thence S. 33° 41′ 18″ W., 254.7 feet to station I (a cross "+" cut in top surface of concrete retaining wall at angle in rear of Wallen Leather Company's tannery); thence S. 37° 40′ 30″ W., 278.2 feet to station J (a cross "+" in center of top surface of west abutment of Wealthy Avenue Bridge, 15.03 feet south of center line of bridge); thence S. 51° 55′ 35″ W., 1,554.6 feet to station K (an iron monument on the right bank of Grand River 116 feet west of the center line of Straight street produced, and 68 feet from low-water shore line on right bank of river). The aforesaid station K bears N. 6° 10′ 35″ W., 452.8 feet from station A, the initial point on the left bank.

Very respectfully, your obedient servant,

M. B. ADAMS,
Colonel, Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

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APPENDIX N N.

IMPROVEMENT OF RIVERS AND HARBORS ON THE EASTERN COAST OF MICHIGAN.

REPORT OF MAJ. LANSING H. BEACH, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1905, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Cheboygan Harbor, Michigan.
2. Alpena Harbor (Thunder Bay River), Michigan.
3. Saginaw, Flint, Shiawassee, and Bad rivers, Michigan.
4. Sebewaing River, Michigan.
5. Harbor of refuge at Harbor Beach, Lake Huron, Michigan.
6. Mouth of Black River, Rouge River, and Monroe Harbor, Michigan.
7. Black River at Port Huron, Michigan.
8. Pine River, Michigan.
9. Belle River, Michigan.
10. Clinton River, Michigan.

HARBOR LINES.

11. Saginaw River at Saginaw, Michigan.

UNITED STATES ENGINEER OFFICE,
Detroit, Mich., July 18, 1905.

GENERAL: I have the honor to transmit herewith the annual reports for the works of river and harbor improvement in my charge for the fiscal year ending June 30, 1905.

Very respectfully,

LANSING H. BEACH,
Major, Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

N N 1.

IMPROVEMENT OF CHEBOYGAN HARBOR, MICHIGAN.

No work was in progress during the past year.

Original estimated cost of dredging and pier construction, 1871..... $395,000.00
Whole amount expended to June 30, 1905 ..... 173,846.68

An examination made at this harbor during the month of June, 1905, showed that no work was necessary at present for the maintenance of the improved channel.

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Money statement.

July 1, 1904, balance unexpended	[a]$2,[illegible]
Amount appropriated by river and harbor act approved March 3, 1905	7,[illegible]
	9,[illegible]
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	151.[illegible]
July 1, 1905, balance unexpended	9,[illegible]
July 1, 1905, outstanding liabilities	242.[illegible]
July 1, 1905, balance available	9,410.42
Amount (estimated) required for completion of existing project	5,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:	
For works of improvement	$5,000.00
For maintenance of improvement	4,000.00
	9,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

March 3, 1871	$10,000	August 2, 1882	$10,000
June 10, 1872	15,000	July 5, 1884	5,000
March 3, 1873	15,000	August 5, 1886	15,000
June 23, 1874	15,000	August 11, 1888	15,000
March 3, 1875	15,000	June 3, 1896	12,000
August 14, 1876	10,000	March 3, 1899	8,000
June 18, 1878	8,000	June 13, 1902	8,000
March 3, 1879	3,000	March 3, 1905	7,500
June 14, 1880	6,000		
March 3, 1881	6,000	Total	183,500

COMMERCIAL STATISTICS.

Receipts and shipments by vessel for the calendar year ended December 31, 1904.

[Compiled from statements furnished by Mr. C. L. Marquette, deputy collector of customs, Cheboygan, Mich.]

Articles.	Received.	Shipped.	Articles.	Received.	Shipped.
	Tons.	*Tons.*		*Tons.*	*Tons.*
Brick	380		Pulp wood		1,[illegible]
Cedar posts		6,893	Spiles		2[illegible]
Beer		200	Tan bark	20	[illegible]
Coal	9,500	842	Telegraph poles		4[illegible]
Flour	182		Ties		25,[illegible]
Hay and feed		8	Barrels	7	[illegible]
Laths		553	Kegs	2	
Lime and cement	908		Beer (cases)	87	
Logs	11,250		Carboys	5	
Lumber	3	58,950	Booms		[illegible]
Mill stuff	165		Wood		[illegible]
Merchandise, general	2,188	3,032	Potatoes		[illegible]
Paper		1,500			
Salt	168	2	Total	24,815	106,[illegible]
Shingles		330			

[a] Erroneously reported last year as $2,311.26.

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N N 2.

IMPROVEMENT OF ALPENA HARBOR (THUNDER BAY RIVER), MICHIGAN.

No work was necessary during the past year. Past experience justifies the expectation that the improved channel will deteriorate very slowly and that no expenditure for maintenance or restoration is likely to be needed in the near future. The large area of impounded water above the dam seems to serve as a settling basin, and but little sediment appears to be carried into the portion of the channel already dredged. For this reason it is not considered necessary to submit an estimate for further appropriation at present.

Original estimate of cost, 1876, 1881, and 1889 (aggregate)	$55,851.48
Whole amount expended to June 30, 1905	49,791.57

Money statement.

July 1, 1904, balance unexpended	$1,825.93
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	117.50
July 1, 1905, balance unexpended	1,708.43

APPROPRIATIONS.

Thunder Bay Harbor, Michigan:	
August 14, 1876	$4,500
August 2, 1882	15,000
September 19, 1890	5,500
Thunder Bay River, Michigan:	
September 19, 1890	10,000
July 13, 1892	10,000
Alpena Harbor, Michigan:	
August 18, 1894	$4,000
June 3, 1896	2,500
Total	51,500

COMMERCIAL STATISTICS.

Receipts and shipments by vessel for the calendar year ended December 31, 1904.

[Compiled from statements furnished by the deputy collector of customs at Alpena, Mich.]

Articles.	Received.	Shipped.	Articles.	Received.	Shipped.
	Tons.	*Tons.*		*Tons.*	*Tons.*
Brick	1,406		Lime and cement		19,500
Cedar posts		10,405	Live stock	26	
Cedar ties		32,094	Lumber		79,065
Coal	22,550		Machinery	300	100
Farm products (miscellaneous)	252	38	Merchandise (general)	11,192	4,519
Fish		872	Paper	5	187
Flour	1,160		Salt	938	
Fruit (miscellaneous)	315	60	Shingles		1,210
Grain	988		Dried hides	90	
Hay and feed	12,500		Total	51,722	150,381
Lath		2,331			

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N N 3.

IMPROVEMENT OF SAGINAW, FLINT, SHIAWASSEE, AND BAD RIVERS, MICHIGAN.

The survey of the Saginaw River at Saginaw, Mich., for the purpose of establishing harbor lines for that city, was completed during July, 1904. A map showing the proposed harbor lines, together with a description of the lines, was submitted to the Chief of Engineers October 6, 1904, and same were approved by the Secretary of War November 19, 1904.

The wreck of the schooner *Garrett Smith*, which had been lying in the Saginaw River near Bay City, Mich., and formed an obstruction to the navigation of the river, was removed by the contractor, H. H. Thomas, during September and November, 1904.

No work was done upon the Flint, Shiawassee, and Bad rivers during the fiscal year, the conditions apparently not warranting any expenditure. The river and harbor act approved March 3, 1905, diverted the sums heretofore appropriated for these rivers and made them available for the improvement of the Saginaw River.

Estimated cost of successive projects, 1867 to 1882	$289,795.00
Estimated cost of project for 1882	446,000.00
Total	735,795.00
Carried to surplus fund	1,000.00
Whole amount expended to June 30, 1905	809,375.46

Money statement.

July 1, 1904, balance unexpended		$31,114.88
Amount appropriated by river and harbor act approved March 3, 1905		30,000.00
		61,114.88
June 30, 1905, amount expended during fiscal year, for maintenance of improvement		2,738.50
July 1, 1905, balance unexpended		58,376.38
July 1, 1905, outstanding liabilities		5.00
July 1, 1905, balance available		58,371.38
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$40,000.00	
For maintenance of improvement	10,000.00	
		50,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897 and of section 7 of the river and harbor act of 1899.

APPROPRIATIONS.

June 23, 1866	$67,500.00	August 11, 1888	$65,000.00
March 2, 1867	28,000.00	September 19, 1890	75,000.00
July 25, 1868 (allotment)	9,000.00	July 13, 1892	100,000.00
July 11, 1870	1,500.00	August 18, 1894	40,000.00
June 23, 1874	15,000.00	June 3, 1896	40,000.00
March 3, 1875	30,000.00	March 3, 1899	40,000.00
August 14, 1876	11,000.00	June 13, 1902	50,000.00
June 18, 1878	25,000.00	Repayments	1.84
March 3, 1879	8,000.00	March 3, 1905	30,000.00
June 14, 1880	15,000.00		
March 3, 1881	10,000.00		868,751.84
August 2, 1882	125,000.00	Carried to surplus fund	1,000.00
July 5, 1884	50,000.00		
August 5, 1886	33,750.00	Balance	867,751.84

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COMMERCIAL STATISTICS.

Receipts and shipments by vessel for the calendar year ended December 31, 1904.

[Compiled from statements furnished by Mr. Wm. G. Emerick, deputy collector, Saginaw, Mich., and Mr. Dewitt C. Brawn, deputy collector, Bay City, Mich.]

Articles.	Received.	Shipped.	Articles.	Received.	Shipped.
	Tons.	*Tons.*		*Tons.*	*Tons.*
Cedar posts	109	.....	Merchandise (general)	.....	1,350
Cedar ties	73	.....	Pickets	6,697	.....
Coal	17,880	.....	Plants	4	.....
Fish packages (empty)	.....	38	Salt	.....	7,452
Flour	60	.....	Stone	10,366	.....
Fish nets	8	.....	Tea	45	.....
Steel	2	.....	Telegraph poles	196	.....
Lath	7,073	.....			
Lumber	221,553	4,170	Total	264,066	13,010

N N 4.

IMPROVEMENT OF SEBEWAING RIVER, MICHIGAN.

No work was in progress at this locality during the past fiscal year. An examination of the river was made during May, 1905, and showed that some shoals had formed, which it is proposed to remove during the summer of 1905.

Money statement.

July 1, 1904, balance unexpended	$538.78
Amount appropriated by river and harbor act approved March 3, 1905	5,000.00
	5,538.78
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	155.34
July 1, 1905, balance unexpended	5,383.44
Amount (estimated) required for completion of existing project	15,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:	
For works of improvement	$15,000.00
For maintenance of improvement	5,000.00
	20,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

March 3, 1875 (river and harbor)	$8,000
June 14, 1880	7,000
June 3, 1896	5,000
March 3, 1899	32,000
March 3, 1905	5,000
Total	57,000

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COMMERCIAL STATISTICS.

Receipts and shipments by vessel for the calendar year ended December 31, 1904.

[Compiled from statements furnished by Messrs. John C. Linken & Co., of Sebewaing, Mich.]

Articles.	Received.	Shipped.	Articles.	Received.	Shipped.
	Tons.	*Tons.*		*Tons.*	*Tons.*
Brick	50	400	Lime and cement	400	.....
Cedar posts	40	.....	Live stock	.....	32
Coal	4,000	10,000	Lumber	1,900	.....
Farm products (miscellaneous)	20	17,000	Merchandise (general)	1,700	300
Fish	20	150	Salt	140	.....
Flour	220	800	Shingles	1,500	.....
Fruit (miscellaneous)	10	90	Stone	250	.....
Grain	1,500	240	Freight, not classified	1,800	1,200
Hay and feed	120	.....	Total	14,770	30,500
Lath	1,100	.....			

NN 5.

IMPROVEMENT OF HARBOR OF REFUGE AT HARBOR BEACH, LAKE HURON, MICHIGAN.

The name of this improvement was changed by act of Congress approved March 3, 1905, from "Sand Beach" to "Harbor Beach," so as to conform with the name of the town, railroad station, and post-office, and existing conditions, the term "Sand Beach" being at present incorrect, as explained in the Annual Report for 1904.

Owing to the lateness of the season the contractors for building the concrete superstructure, Messrs. Hugo & Tims, of Duluth, Minn., were unable to begin work until the middle of June, 1904, and owing to the inclement season a smaller amount of work was accomplished than was hoped. The contractors resumed operations in the spring of 1905 before the ice was off the piers, and during the months of May and June made very material progress. At the close of the year the old timber superstructure had been torn out to station 607 on the inside portion of the pier and to station 496 on the outer portion, the footing blocks had been set in position to station 597 on the inner side of the pier, and good progress had also been made with the completed section. It is believed that this season will show a large amount of work accomplished.

Bids were received June 10, 1905, for rebuilding so much of the superstructure of the main pier as could be accomplished with the appropriation of $200,000 made by the river and harbor act of March 3, 1905. The contract had not, however, been awarded at the close of the fiscal year.

An emergency contract was made with James Davidson, of Bay City, Mich., for dredging test pits in the harbor for the purpose of obtaining information for the report requested by Congress concerning the changes necessary to be made in the harbor to adapt it to the present demands of commerce. This report will be submitted separately later.

A survey of the harbor was made during February and March, 1905, soundings being taken through the ice. The soundings taken showed a gradual filling of the harbor, the material apparently coming through the western or shore portion. The construction of an interior pier would, it is believed, remedy this tendency of the harbor to silting.

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Repairs were made at different times during the year to the portions of the main pier not under contract. The hemlock timber of which this pier is built is decaying very rapidly, and unless it is soon rebuilt in concrete it will be necessary to practically reconstruct it in timber.

An appropriation of $300,000 should be provided at as early a date as possible to permit the completion of the superstructure of the main pier in concrete and for other necessary expenses of the work.

Original estimated cost of the work	$1,442,500.00
Amount carried to surplus fund	30,000.00
Whole amount expended to June 30, 1905	1,347,021.45

Money statement.

July 1, 1904, balance unexpended		$269,774.66
Amount appropriated by river and harbor act approved March 3, 1905		200,000.00
		469,774.66
June 30, 1905, amount expended during fiscal year, for maintenance of improvement		52,949.90
July 1, 1905, balance unexpended		416,824.76
July 1, 1905, outstanding liabilities		21,997.40
July 1, 1905, balance available		394,827.36
July 1, 1905, amount covered by uncompleted contracts		153,410.69
Amount (estimated) required for continuation of project		300,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$300,000.00	
For maintenance of improvement	10,000.00	
		310,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

APPROPRIATIONS.

March 3, 1871	$100,000.00	April 28, 1904	$50,000.00
June 10, 1872	100,000.00		
March 3, 1873	75,000.00	Total	1,593,500.00
June 23, 1874	75,000.00	Carried to surplus fund	30,000.00
March 3, 1875	100,000.00		
August 14, 1876	75,000.00		1,563,500.00
June 18, 1878	100,000.00	September 4, 1897, amount collected on account of damage to piers and deposited to credit of appropriation	107.05
March 3, 1879	75,000.00		
June 14, 1880	75,000.00		
March 3, 1881	50,000.00		
August 2, 1882	75,000.00		
July 5, 1884	75,000.00		
August 5, 1886	75,000.00		
August 11, 1888	70,000.00		
September 19, 1890	30,000.00		
July 13, 1892	150,000.00	March 10, 1902, amount collected on account of damage to piers and deposited to credit of appropriation	200.78
August 18, 1894	20,000.00		
June 3, 1896	16,000.00	Received from sales	38.38
March 3, 1899	50,000.00	March 3, 1905	200,000.00
June 6, 1900	150,000.00		
June 13, 1902	7,500.00	Total	1,763,846.21

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CONTRACTS IN FORCE.

Contract in force with Hugo & Tims, of Duluth, Minn., for rebuilding superstructure of main pier in concrete, approved August 28, 1903; date of beginning work June 12, 1904; and emergency contract with James Davidson, of Bay City, Mich., dated June 5, 1905, for dredging test pits in the harbor. The work was done between June 26 and June 28, 1905.

COMMERCIAL STATISTICS.

TABLE No. 1.—*Summary of vessels sheltered in the harbor of refuge at Harbor Beach, Mich., from July 1, 1904, to June 30, 1905, and the direction of wind at time of entering the harbor.*

Direction of wind at time of entering.	1904.						1905.			Total.
	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Apr.	May.	June.	
North:										
Steam	11	17	26	4	28	3	20	8	21	[illegible]
Sail	0	8	2	0	4	0	1	2	4	[illegible]
Tows	1	3	5	0	7	1	4	1	1	[illegible]
Total	12	28	33	4	39	4	25	11	26	[illegible]
Northwest:										
Steam	16	14	17	41	45	8	9	20	4	[illegible]
Sail	4	5	2	0	0	0	1	3	1	[illegible]
Tows	1	1	8	8	13	0	4	3	4	[illegible]
Total	21	20	27	49	58	8	14	26	9	[illegible]
West:										
Steam	7	12	20	12	11	5	4	5	10	[illegible]
Sail	0	1	4	1	0	0	0	1	1	[illegible]
Tows	0	3	8	0	1	0	0	1	0	[illegible]
Total	7	16	32	13	12	5	4	7	11	[illegible]
Southwest:										
Steam	25	21	18	24	32	0	7	11	13	[illegible]
Sail	2	3	3	5	2	0	1	2	2	[illegible]
Tows	7	0	0	4	4	0	0	3	0	[illegible]
Total	34	24	21	33	28	0	8	16	15	[illegible]
South:										
Steam	1	17	8	7	10	0	1	7	4	[illegible]
Sail	2	1	0	4	0	0	0	3	0	[illegible]
Tows	0	1	0	4	4	0	0	0	0	[illegible]
Total	3	19	8	15	14	0	1	10	4	[illegible]
Southeast:										
Steam	5	15	13	16	8	0	3	16	9	[illegible]
Sail	0	0	7	0	2	0	1	0	1	[illegible]
Tows	0	0	0	4	0	0	0	2	1	[illegible]
Total	5	15	20	20	10	0	4	18	11	[illegible]
East:										
Steam	9	4	2	0	0	0	1	1	8	[illegible]
Sail	0	0	0	0	0	0	0	0	0	[illegible]
Tows	0	0	0	0	0	0	0	0	0	[illegible]
Total	9	4	2	0	0	0	1	1	8	[illegible]
Northeast:										
Steam	26	16	9	15	9	4	0	10	11	[illegible]
Sail	1	0	1	2	0	1	0	0	1	[illegible]
Tows	3	4	1	5	6	0	0	0	4	[illegible]
Total	30	20	11	22	15	5	0	10	16	[illegible]
Total each month:										
Steam	100	116	113	119	143	20	45	78	80	[illegible]
Sail	9	18	19	12	8	1	4	11	10	[illegible]
Tows	12	12	22	25	35	1	8	10	10	[illegible]
Total	121	146	154	156	186	22	57	99	100	1,041

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TABLE No. 2.—*Classified table of tonnage, by months, sheltered in the harbor of refuge at Harbor Beach, Mich., from July 1, 1904, to June 30, 1905.*

Date.	Steam.		Sail.		Tow.		Total.	
	Number.	Tonnage.	Number.	Tonnage.	Number.	Tonnage.	Number.	Tonnage.
1904.								
July	100	90,398	9	758	12	6,618	121	97,750
August	116	97,240	18	1,589	12	7,208	146	105,987
September	113	101,948	19	2,698	22	13,102	154	117,738
October	119	93,581	12	2,112	25	14,100	156	109,793
November	143	112,479	8	1,269	35	19,843	186	133,591
December	20	23,845	1	90	1	1,972	22	25,907
1905.								
April	45	34,454	4	787	8	6,179	57	41,420
May	78	49,800	11	1,374	10	4,952	99	56,126
June	80	66,264	10	1,720	10	5,301	100	73,285
Total	814	669,999	92	12,337	135	79,270	1,041	761,606

TABLE No. 3.—*Number and tonnage of vessels sheltered in the harbor of refuge at Sandbeach, Michigan, 1877 to 1904, inclusive.*

Calendar year.	Steam.	Sail.	Tow.	Total.	Total vessels.	Average tonnage.
	Tons.	*Tons.*	*Tons.*	*Tons.*		
1877	63,966	27,699	50,954	142,610	493	289
1878	104,025	39,699	99,282	243,006	781	311
1879	133,080	45,750	100,096	278,926	921	303
1880	158,720	55,630	147,260	361,610	1,317	275
1881	144,645	55,960	127,855	328,460	1,176	279
1882	146,132	26,504	114,067	282,703	1,022	280
1883	177,122	32,713	114,091	323,926	1,139	284
1884	156,518	34,724	122,980	314,222	1,142	275
1885	196,364	29,426	151,607	377,397	1,158	326
1886	196,335	33,790	140,682	370,987	1,304	284
1887	271,327	33,689	153,087	458,103	1,447	317
1888	271,917	39,756	202,191	513,864	1,624	316
1889	287,719	37,922	165,896	493,581	1,512	326
1890	325,852	38,826	169,104	533,782	1,575	339
1891	296,917	27,076	171,067	491,060	1,341	366
1892	362,486	29,465	162,605	554,556	1,441	385
1893	243,451	20,897	113,915	378,268	962	385
1894	321,511	22,961	134,034	478,506	1,150	416
1895	356,532	26,898	167,327	550,668	1,204	451
1896	246,447	24,621	105,988	377,087	1,073	351
1897	304,460	21,151	157,776	479,387	1,205	398
1898	505,630	18,090	107,176	630,980	1,204	525
1899	590,547	20,854	81,143	692,544	1,254	544
1900	617,161	20,919	124,924	763,004	1,266	603
1901	744,154	16,841	151,023	912,018	1,338	682
1902	747,179	21,871	124,139	893,099	1,349	662
1903	662,724	12,167	105,650	780,541	1,081	722
1904	601,872	9,582	67,474	678,874	922	736
Total	9,234,791	825,337	3,633,583	13,693,711	33,412	.....

N N 6.

IMPROVEMENT OF MOUTH OF BLACK RIVER, ROUGE RIVER, AND MONROE HARBOR, MICHIGAN.

(A) MOUTH OF BLACK RIVER.

No work was in progress at this locality during the past fiscal year.

Original estimated cost (1871) of removing middle ground to depth of—
15 feet $67,320.00
18 feet 157,520.00
Whole amount expended to June 30, 1905 ..... 93,886.14

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Money statement.

July 1, 1904, balance unexpended	$5,620.12
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	6.26
July 1, 1905, balance unexpended	5,613.86

APPROPRIATIONS.

Mouth of Black River, in St. Clair River, Michigan:	
June 10, 1872	$15,000
St. Clair River, at mouth of Black River, Michigan:	
March 3, 1873	15,000
June 23, 1874	15,000
March 3, 1875	10,000
June 18, 1878	1,500
Mouth of Black River, Michigan:	
August 11, 1888	10,000
Mouth of Black River, Michigan—Continued.	
September 19, 1890	$10,000
July 13, 1892	10,000
August 18, 1894	4,000
June 3, 1896	4,000
March 3, 1899	4,000
June 13, 1902 (allotment)	1,000
Total	99,500

(B) ROUGE RIVER.

No work was in progress at this locality during the past fiscal year.

Original estimated cost of the work, 1887	$31,690.39
Whole amount expended to June 30, 1905	51,507.28

Money statement.

July 1, 1904, balance unexpended		$199.72
Amount appropriated by river and harbor act approved March 3, 1905		8,000.00
		8,199.72
June 30, 1905, amount expended during fiscal year, for maintenance of improvement		17.00
July 1, 1905, balance unexpended		8,182.72
Amount (estimated) required for completion of existing project		28,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$5,000.00	
For maintenance of improvement	8,000.00	
		13,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

APPROPRIATIONS.

August 11, 1888	$10,000
September 19, 1890	10,000
July 13, 1892	11,690
August 18, 1894	5,000
June 3, 1896	5,000
March 3, 1899 (transferred from appropriation for constructing turning basin in Rouge River, Michigan)	5,000
June 13, 1902 (allotment)	5,000
March 3, 1905 (allotment)	8,000
Total	59,690

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COMMERCIAL STATISTICS.

Receipts and shipments by vessel for the year ended December 31, 1904.

[Compiled from statements furnished by those doing business along the river front.]

Articles.	Received.	Shipped.	Articles.	Received.	Shipped.
	Tons.	*Tons.*		*Tons.*	*Tons.*
Barrel headings	291		Salt	4,563	
Cement	1,000		Soda ash		5,000
Iron, pig		1,898	Shingles	59	
Laths	848		Wood	27,000	
Lumber	56,905				
Ore, iron	151,195		Total	242,861	6,898

(C) HARBOR AT MONROE.

No work was in progress at this locality during the past fiscal year. The timber of which the piers are constructed has decayed very badly, and it is intended to make such repairs as are necessary during the summer of 1905.

Money statement.

July 1, 1904, balance unexpended	$166.65
Amount appropriated by river and harbor act approved March 3, 1905	5,000.00
	5,166.65
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	18.24
July 1, 1905, balance unexpended	5,148.41
July 1, 1905, outstanding liabilities	150.30
July 1, 1905, balance available	4,998.11
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	5,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

APPROPRIATIONS.

February 24, 1835	$30,000.00	June 14, 1880	$2,000.00
July 2, 1836	15,000.00	March 3, 1881	1,000.00
March 3, 1837	30,000.00	August 2, 1882	1,000.00
July 7, 1838	15,000.00	August 5, 1886	2,000.00
June 11, 1844	20,000.00	August 11, 1888	5,000.00
August 30, 1852	14,000.00	September 19, 1890	5,000.00
June 23, 1866	31,015.27	July 13, 1892	10,000.00
June 10, 1872	10,000.00	August 18, 1894	5,000.00
March 3, 1873	15,000.00	June 3, 1896	5,000.00
June 23, 1874	10,000.00	March 3, 1899	5,000.00
March 3, 1875	10,000.00	June 13, 1902 (allotment)	1,500.00
August 14, 1876	5,000.00	March 3, 1905 (allotment)	5,000.00
June 8, 1878	2,500.00		
March 3, 1879	2,000.00	Total	257,015.27

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COMMERCIAL STATISTICS.

Receipts and shipments by vessel for the year ended December 31, 1904.

[Compiled from statements furnished by Mr. Arthur S. Dewey, deputy collector of customs, Monroe, Mich.]

Articles.	Received.	Shipped.
	Tons.	*Tons.*
Coal	219	
Fish	25	162
Merchandise (general)	2	41
Sand	5,810	
Total	6,056	203

N N 7.

IMPROVEMENT OF BLACK RIVER AT PORT HURON, MICHIGAN.

No work was in progress at this locality during the past fiscal year.

Original estimated cost of 16-foot channel, 1891	$75,000.00
Whole amount expended to June 30, 1905	46,872.90

Money statement.

July 1, 1904, balance unexpended		$127.10
July 1, 1905, balance unexpended		127.10
Amount (estimated) required for completion of existing project		28,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$10,000.00	
For maintenance of improvement	8,000.00	
		18,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

APPROPRIATIONS.

September 19, 1890	$25,000
July 13, 1892	10,000
August 18, 1894	4,000
June 3, 1896	4,000
March 3, 1899	4,000
Total	47,000

COMMERCIAL STATISTICS.

Receipts by vessel for the calendar year ended December 31, 1904.

[Compiled from statements furnished by Mr. Lincoln Avery, collector of customs.]

Articles.	Received.	Articles.	Received.
	Tons.		*Tons.*
Brick	7,500	Lumber	14,123
Cedar posts	16,000	Shingles	1,089
Coal	36,882	Pulp wood	52,000
Gravel	45,500	Wood	21,600
Lath	1,080		
Lime and cement	1,320	Total	197,044

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N N 8.

IMPROVEMENT OF PINE RIVER, MICHIGAN.

No work was done at this locality during the past fiscal year. A balance of $1,185.21 from the last appropriation is on hand, which will probably suffice to meet all cost of maintenance and general contingencies of engineering, office, etc., for some time to come. Further appropriation is therefore unnecessary at present.

Original estimated cost of work, 1895	$10,560.00
Whole amount expended on present project to June 30, 1905	9,374.79

Money statement.

July 1, 1904, balance unexpended	$1,335.41
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	150.20
July 1, 1905, balance unexpended	1,185.21

APPROPRIATIONS.

March 3, 1875	$5,000
June 3, 1896	5,000
March 3, 1899	5,560
Total	15,560

COMMERCIAL STATISTICS.

Receipts and shipments by vessel for the calendar year ended December 31, 1904.

[Compiled from statements furnished by Mr. David P. Ingles, deputy collector, St. Clair, Mich.]

Articles.	Received.	Shipped.
	Tons.	*Tons.*
Brick		3,860
Coal	5,827	
Logs		187
Bolts		250
Wood	237	
Total	6,064	4,297

N N 9.

IMPROVEMENT OF BELLE RIVER, MICHIGAN.

No work was done at this locality during the past fiscal year. No additional appropriation is necessary, as the unexpended balance of the last one will provide for all probable expenses of maintenance, supervision, etc., for some considerable time to come.

Original estimated cost of work, 1895	$21,340.00
Whole amount expended on present project to June 30, 1905	11,090.46

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Money statement.

July 1, 1904, balance unexpended	$4,059.54
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	150.00
July 1, 1905, balance unexpended	3,909.54

APPROPRIATIONS.

March 3, 1881 (ice harbor of refuge)	$7,000
August 2, 1882 (ice harbor of refuge)	5,000
July 5, 1884 (ice harbor of refuge)	2,000
June 3, 1896	5,000
March 3, 1899	10,000
Total	29,000

COMMERCIAL STATISTICS.

Receipts and shipments by vessel for the calendar year ended December 31, 1904.

[Compiled from statements furnished by Mr. R. B. W. Beattie, deputy collector of customs, Marine City, Mich.]

Articles.	Received.	Shipped.
	Tons.	Tons.
Cedar posts	340	280
Coal	1,000	.....
Gravel	2,925	.....
Hay and feed	.....	90
Laths	20	.....
Lumber	1,451	350
Shingles	41	26
Total	5,777	846

N N 10.

IMPROVEMENT OF CLINTON RIVER, MICHIGAN.

No work was in progress at this locality during the past fiscal year.

Original estimated cost of work, 1885, as amended 1899	$34,564.00
Whole amount appropriated and expended prior to adoption of present project	25,500.00
Whole amount expended on present project to June 30, 1905	47,220.69

Money statement.

July 1, 1904, balance unexpended	$2,502.34
Amount appropriated by river and harbor act approved March 3, 1905	3,000.00
	5,502.34
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	159.03
July 1, 1905, balance unexpended	5,343.31
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	5,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

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APPROPRIATIONS.

August 30, 1852	$5,000	September 19, 1890	$10,000
July 11, 1870	5,000	July 13, 1892	8,564
March 3, 1871	1,500	August 18, 1894	5,000
March 3, 1881	8,000	June 3, 1896	10,000
August 2, 1882	6,000	March 3, 1905	3,000
August 5, 1886	6,000		
August 11, 1888	10,000	Total	78,064

COMMERCIAL STATISTICS.

Receipts and shipments by vessel for the calendar year ended December 31, 1904.

[Compiled from statements furnished by Mr. John T. Rich, collector of customs, Detroit, Mich.]

Articles.	Received.	Shipped.	Articles.	Received.	Shipped.
	Tons.	*Tons.*		*Tons.*	*Tons.*
Cedar posts	86		Sand	1,407	
Coal	16,321		Staves		205
Lime and cement	228		Headings		52
Logs	2,520				
Lumber	1,804		Total	22,878	257
Stone	512				

N N 11.

ESTABLISHMENT OF HARBOR LINES IN SAGINAW RIVER AT SAGINAW, MICHIGAN.

UNITED STATES ENGINEER OFFICE,
Detroit, Mich., March 11, 1903.

GENERAL: I have to inclose herewith a letter from the city engineer of the city of Saginaw, Mich., inclosing duly certified copy of a message[a] from the mayor of that city urging the importance of establishing a harbor line, and a request by the city council that such action be taken.

It is believed that the establishment of harbor lines by the Government is essential to the proper preservation of the interests of navigation at this locality. I would therefore recommend that favorable action be taken upon the application of the city authorities of the city of Saginaw, and that harbor lines upon this portion of the Saginaw River be properly established.

It should be stated in this connection that the city of Saginaw, under municipal authority, some years ago established a harbor line upon the east side of the river, in a location such that, if wharves were built to it, vessels lying at such wharves would prevent the passage of other vessels through the draws of the adjacent bridges. The city authorities are willing to annul this harbor line provided one can be established in its place by proper authority.

Very respectfully,

LANSING H. BEACH,
Major, Corps of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. A.
(Through the Division Engineer.)

[a] Not printed.

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[First indorsement.]

OFFICE DIVISION ENGINEER, NORTHWEST DIVISION,
Chicago, Ill., March 12, 1903.

Respectfully forwarded to the Chief of Engineers, recommended for approval.

O. H. ERNST,
Colonel, Corps of Engineers,
Division Engineer, Northwest Division.

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
March 17, 1903.

Respectfully returned to Major Beach, who is authorized to consider and report upon the subject of the establishment of harbor lines at the locality in question, attention being invited to the provisions of section 11 of the river and harbor act approved March 3, 1899.

After the matter has been carefully investigated and tentative lines have been drawn upon a convenient map, the whole subject will be considered at a public hearing, previously advertised, at which all interested parties will be given full opportunity to examine the proposed lines and express their views thereon.

With his final report on the proposed lines, Major Beach will submit a tracing showing the lines, with proper description, which in his opinion will best subserve the various interests involved.

In this connection attention is invited to the fact that the matter of the establishment of the harbor lines is one which should be treated with great care. The lines to be approved should be so marked and described that their position at any point of the locus may be determined with precision and without unusual difficulty, and the monuments to which they are referred should be such as are not likely to be disturbed by ordinary changes. Furthermore, the lines should be so fixed, with regard to present and future land and water interests, that the necessity for future modifications may be obviated so far as possible, and thus reduce to a minimum the likelihood of embarrassing controversies arising, in which the rights of property and the efficiency of the work of the department may be brought in question.

To be returned.

A. MACKENZIE,
Acting Chief of Engineers.

(Through the Division Engineer.)

[Third indorsement.]

OFFICE DIVISION ENGINEER, NORTHWEST DIVISION,
Chicago, Ill., March 20, 1903.

Respectfully transmitted to Maj. Lansing H. Beach.

O. H. ERNST,
Colonel, Corps of Engineers,
Division Engineer, Northwest Division.

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[Fourth indorsement.]

U. S. ENGINEER OFFICE,
Detroit, Mich., February 25, 1904.

Respectfully returned to the Chief of Engineers, with tracing[a] showing the proposed harbor lines for Saginaw River within the limits of the city of Saginaw, Mich., together with a description of the lines shown upon the map.

The lines have been drawn after consultation with the property owners along the river front, the vessel men, and the city authorities, and, as will be seen from the description, are referred as far as practicable to city datum points. The description is given for one side of the river only, the other side being laid parallel to and 430 feet from the line described. This was thought preferable to attempting to describe both sides, as if two sides were described separately a slight difference in location would involve an uncertainty as to which should be the governing line and produce a corresponding uncertainty; with one line as the datum and the other referred to it, such ambiguity would be avoided.

LANSING H. BEACH,
Major, Corps of Engineers.

[Seventh indorsement.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, November 17, 1904.

Respectfully submitted to the Secretary of War.

Request is made by the authorities of the city of Saginaw, Mich., for the establishment of harbor lines on Saginaw River within the corporate limits of said city.

The request is presented through Maj. Lansing H. Beach, Corps of Engineers, the local engineer officer, who states that in his opinion the establishment of harbor lines by the United States is essential to the preservation of the interests of navigation at the locality in question.

By direction of this office Major Beach has given the matter careful consideration, and, after consultation with property owners along the river front, vessel men, and the city authorities, has selected lines for adoption by the Secretary of War under authority conferred by section 11 of the river and harbor act approved March 3, 1899.

Concurring in the views of the local officer, I recommend that the harbor lines selected by him, which are delineated upon the accompanying chart[a] and described in a separate paper herewith, be approved.

Should this recommendation meet with the concurrence of the Secretary of War, I further recommend that he indicate his approval on the description as well as the tracing, both of which have been prepared for his signature.

A. MACKENZIE,
Brig. Gen., Chief of Engineers, U. S. Army.

DESCRIPTION OF PROPOSED HARBOR LINES ON SAGINAW RIVER, MICHIGAN, WITHIN THE CITY OF SAGINAW, MICH.

The harbor lines as recommended and shown on the accompanying map[a] are two lines, the angular points of which are numbered from 1 to 30, inclusive. The

[a] Not printed.

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odd numbers represent the points along the easterly or right bank of the river, and the even numbers those along the westerly shore, or left bank.

The east line is described as follows:

1. *Initial point.*—In center line of Youmans street, South Saginaw, 766.5 feet from center line of Douglass street; thence N. 8° 25′± W. 1,322± feet to a point, being

3. On the center line of the Pere Marquette Belt Line Railroad bridge 645.6 feet from the center of River street, said line intersecting said River street at a point 131 feet distant from the center of Gilmore street at an angle of 87° 4′. Two white-oak posts or stakes, marked "U. S.," are driven on said line 440 feet apart, the nearest to point 3 being 229.6 feet distant therefrom; thence N. 7° 5′± W. 2,654± feet to a point, being

5. In the river, on the center line of Cambrey street prolonged and 1,302 feet from the center line of Mackinaw street. This point is 160 feet from the face of the present outlet of the Cambrey street sewer and 200 feet from an oak stake driven 40 feet back of the face of the outlet upon the axis of Cambrey street; thence N. 8° 25′± E. 2,122± feet to a point, being

7. In the river, 151 feet from a white-oak post or stake on the bank of the river and 323 feet from another stake, the latter being located in the center line of Mackinaw street prolonged northerly and 1,264.5 feet distant from the intersection of Webber street, the angle between said extended line and the range line of the two stakes and point 7 being 59° 36′; thence N. 18° 15′± E. 843± feet to a point, being

9. In the river at the intersection of the two sides of a triangle whose base is the distance between points 11 and 12, hereinafter described, the angle at 11 being 94° 30′ and the angle at 12 being 61° 10′. It is also 190 feet from a white-oak stake on the east bank and 450 feet from point 10, the points 9 and 10 and the stake being on range. Thence N. 40° 40′± E. 914± feet to a point, being

11. On the center line of Court street and 203.2 feet from the angle in said street. This point is marked by a spike in the axis of the Court Street Bridge. Thence N. 48° 5′± E. 1,636± feet to a point, being

13. In the river, on the center line of Monroe street extended across the river, 613 feet from the center line of Niagara street and 120 feet from a white-oak post or stake driven on the east bank of the river on the said extended center line of Monroe street. Thence N. 56° 10′± E. 2,147± feet to a point, being

15. On the center line of Bristol street, east side, 574.8 feet from the center line of Tilden street. This point is marked by a spike in the axis of the Bristol Street Bridge. Thence N. 48° 45′± E. 1,532± feet to a point, being

17. A spike in the top timber of the wharf of Mitts & Merrill's foundry, in the prolongation of the center line of Holden street and 214 feet distant from the axis of Tilden street. Thence N. 28°± E. 926± feet to a point, being

19. 228.7 feet from the axis of Tilden street, upon a line drawn from a point of said axis 18.8 feet north of the axis of Emerson street and making an angle of 89° 39′ with the axis of Tilden street to the south of said line. It is marked by a spike in the center of the Michigan Central Railroad bridge. Thence N. 23° 20′± E. 888± feet to a point, being

21. 215 feet from the center line of Tilden street, upon a line drawn through a point upon said center line 25 feet northward from its intersection with the north line of Thompson street and making an angle of 80° 21′ with said center line of Tilden street. This point is at present marked by a spike on the axis of the Grand Trunk Railroad bridge. Thence N. 15° 30′± E. 1,825± feet to a point, being

23. In the center line of Genesee avenue, 165.5 feet from its intersection with the center line of Tilden street. Thence N. 14°± E. 876± feet to a point, being

25. In the center line of Johnson street, 166 feet from its intersection with the center line of Tilden street. Thence N. 12° 45′ E. 1,965 feet to a point, being

27. On the southwest corner of the wharf and warehouse of Symons Bros. & Co., 200 feet from an iron bolt driven in the ground on line with the south line of said warehouse, which bolt is 479.3 feet distant from an iron monument at the intersection of Washington avenue and Potter street, measured on a line forming an angle with said Washington avenue of 53° 49′. The angle between this line and the south line of the warehouse is 22° 13′. Thence N. 14° 30′± E. 490± feet to a point, being

29. *Point of termination.*—697.8 feet from the axis of Washington avenue, on a line making an angle of 89° 15′ with said axis and intersecting it at a point 150.3 feet northwardly from an iron monument at the intersection of Washington avenue and Potter street. Point No. 29 is marked by a spike in the center line of the Pere Marquette Railroad bridge.

The west line is described as follows:

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2. *Initial point.*—In the river near the west bank on line with the axis of Youmans street prolonged across the stream, 1,196.5 feet from the center of Douglass street and 430 feet distant from point No. 1; also 25.5 feet from an oak post or stake, marked "U. S." and driven on the west bank on said line. Thence N. 8° 45′± W. 1,300± feet to a point, being

4. 430.4 feet from point No. 3 in the line determining said point 3, and 1,076 feet from the axis of River street on the said line. It is marked by a spike on the center line of the Pere Marquette Belt Line Railroad bridge. Thence N. 7°± W. 2,703± feet to a point, being

6. In the river upon the axis of Cambrey street prolonged, and 1,733 feet from the axis of Mackinaw street. It is also 38 feet eastwardly from an oak stake driven on the old lumber dock and in the axis of Cambrey street. Thence N. 8° 30′± E. 2,214± feet to a point, being

8. In the river near the northeast corner of an unused pile and slab dock and 431 feet from point 7 upon the line connecting it and the stakes by which point 7 is determined. An oak stake is driven in the dock 5 feet south of the range and 40 feet from point 8. Thence N. 17° 15′± E. 964± feet to a point, being

10. Marked by a spike driven in the top timber of the Michigan Central Railroad wharf, 172 feet from the center line of Niagara street and 187.6 feet from the center line of Mackinaw street, measurements being made at right angles with said streets, respectively. Thence N. 41° 10′± E. 1,053± feet to a point, being

12. The axis of Court street, 166.8 feet from the center line of Niagara street. It is marked by a spike in the center line of the Court Street Bridge. Thence N. 48° 5′± E. 1,660± feet to a point, being

14. In the river, on the center line of Monroe street, 180 feet from the center line of Niagara street and 80 feet from an oak post driven in the axis of Monroe street. Thence N. 55° 50′± E. 2,265± feet to a point, being

16. The northeast corner of the wharf of the A. W. Wright Lumber Company, 314.6 feet from the center line of Niagara street at its intersection with the northerly boundary line of said company's mill property. Thence N. 48° 15′± E. 1,336± feet to a point, being

18. On an island formed by the remains of an abandoned lumber dock in front of Henry Passolt's soap factory and at the intersection of two sides of a triangle whose base is the distance between points 19 and 20, the angle at 19 being 57° 50′, that at 20 being 95° 15′. The point is marked by an oak stake 115 feet from the nearer of two oak stakes 50 feet apart on the west bank and on the line joining points 17 and 18, and also 420.9 feet, measured along the same line, from the axis of Niagara street. Thence N. 28° 30′± E. 804± feet to a point, being

20. 659.4 feet from the center line of Tilden street on the line determining point No. 19. It is marked by a spike on the center line of the Michigan Central Railroad bridge. Thence N. 23° 20′± E. 892± feet to a point, being

22. 651 feet from the axis of Tilden street upon the line used to determine point No. 21, and 436 feet from point No. 21 on said line. It is marked by a spike in the center of the Grand Trunk Railroad bridge. Thence N. 15° 30′± E. 1,748± feet to a point, being

24. In the axis of Genesee avenue, 242.7 feet from the intersection of the west line of Niagara street, 430 feet from point No. 23 and 595.5 feet from the axis of Tilden street. Thence N. 14°± E. 880± feet to a point, being

26. In the axis of Johnson street, 596 feet from the center line of Tilden street. Thence N. 12° 45′± E. 1,960± feet to a point, being

28. In the river, 433 feet from point No. 27 on the range with said point No. 27 and an iron bolt 200 feet east of same, as hereinbefore described. It is 599.2 feet from a spike upon said range and in the floor of a road bridge near C. S. Bliss & Co.'s mill office. Thence N. 14° 30′± E. 591± feet to a point, being

30. *Point of termination.*—1,141.3 feet from the axis of Washington avenue on a line making an angle of 89° 15′ with said axis and intersecting it at a point 150.3 feet northwardly from an iron monument at the intersection of Washington avenue and Potter street. Point No. 30 is marked by a spike in the center line of the Pere Marquette Railroad bridge.

WAR DEPARTMENT,
November 19, 1904.

Approved.

ROBERT SHAW OLIVER,
Acting Secretary of War.

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